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Taste and Odor. Missouri River, Iowa Tributaries Area Iowa-Nebraska, 1970

Environmental Protection Agency, Kansas City, Mo Region VII

1970

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INTERIM REPORT

WATER QUALITY INVESTIGATIONS

TASTE & ODOR

MISSOURI RIVER,
MAIN TRIBUTARIES AREA
IOWA-NEBRASKA, 1970

PB 259 669

Environmental Protection Agency
Region VII
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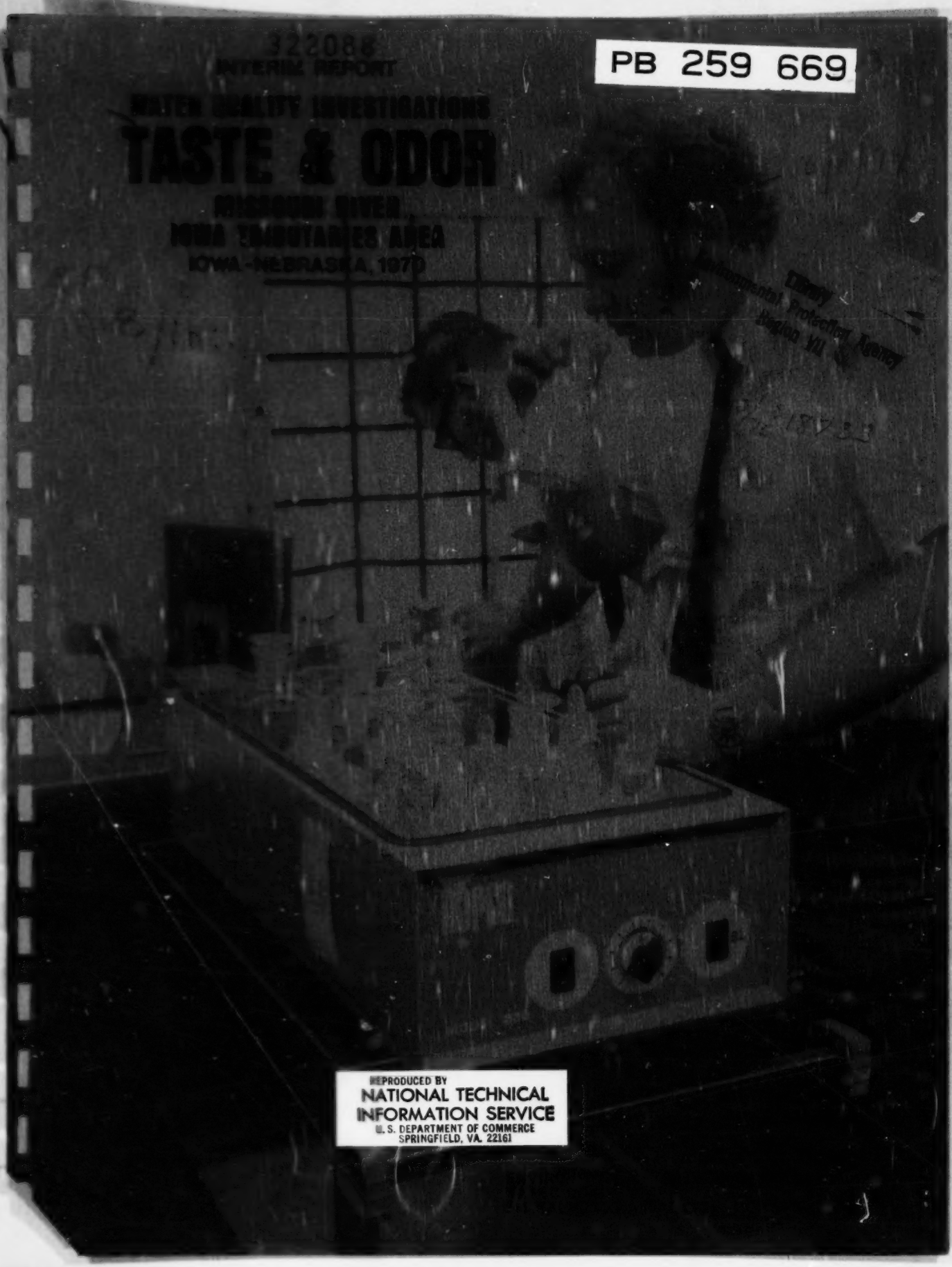

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Auxiliary purposes were to maintain current data on the Missouri River in the area adjacent to Iowa and to collect baseline data for evaluation of quality characteristics of runoff from agricultural lands.

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PURPOSE

The investigation effort reported on was developed following requests from the Omaha Metropolitan Utility District for assistance in determining the causative agent or agents of the recurrent taste and odor problems experienced by the Omaha waterworks.

Auxiliary purposes were to maintain current data on the Missouri River in the area adjacent to Iowa and to collect baseline data for evaluation of quality characteristics of runoff from agricultural lands.

IOWA TRIBUTARIES - TASTE AND ODOR STUDY

Introduction and Summary of Past Activities

Objectionable taste and odors in waters for water supply drawn from the Main Stem of the Missouri River have been the object of numerous limited studies during the past 20 years. None of these past efforts by local State and Federal groups have been conclusive or yielded solutions to the problem.

As a result of the past investigations, several pertinent facts have become known:

1. Odorous substances in the Missouri River reach water plant intakes in slugs. Major sources of tastes and odors occur with runoff conditions where turbidities are on the increase and when there is an abrupt rise or fall in the river level. [1]
2. Natural decomposition products flushed from tributary streams during the spring flush may be a major cause of taste and odor problem with the water of the Main Stem Missouri River. [8]
3. Threshold odor data are a most important parameter which could become a more useful analytical tool in water treatment. [2]

Survey Work Schedule

Significant tributary inflows from above the Big Sioux River to the Omaha waterworks intake were sampled as listed below:

TABLE 1

Station #	Storet #	Description	River Mile
M-51.1	300222	Missouri River Above Sioux City in South Sioux City, Nebraska from Bank	734.5

TABLE 1 contd.

Station #	Storet #	Description	River Mile
BS-51	180015	Big Sioux River at I-29 Highway Bridge	734.0
F-50.5	180020	Floyd River at Dace Avenue Bridge	731.2
SC-49	180013	Sioux City STP Effluent	729.7
IBP-48.5	180019	Iowa Beef Packers, Inc. Effluent Dakota City Nebraska	726.2
LS-45.5	180018	Little Sioux River at I-29 Bridge	669.2
S-45	180009	Soldier River at I-29 Bridge	664.0
B-43	180007	Boyer River at I-29 Bridge	635.1
M-42	180006	Missouri River at Omaha Waterworks Intake	626.2

The location of the samples in the study area is shown on the base map on the following page.

Fifteen sample runs at approximately 3 day intervals were scheduled to determine selected parameters before, during and after the expected flush of accumulated taste and odor causing materials. The parameters selected for study are listed below with a brief discussion of their anticipated significance in relation to the taste and odor problem.

Group A - Baseline and Physical Parameters

a. Date and Time
b. Visual Appearance
c. Temperature
d. pH
e. Conductivity

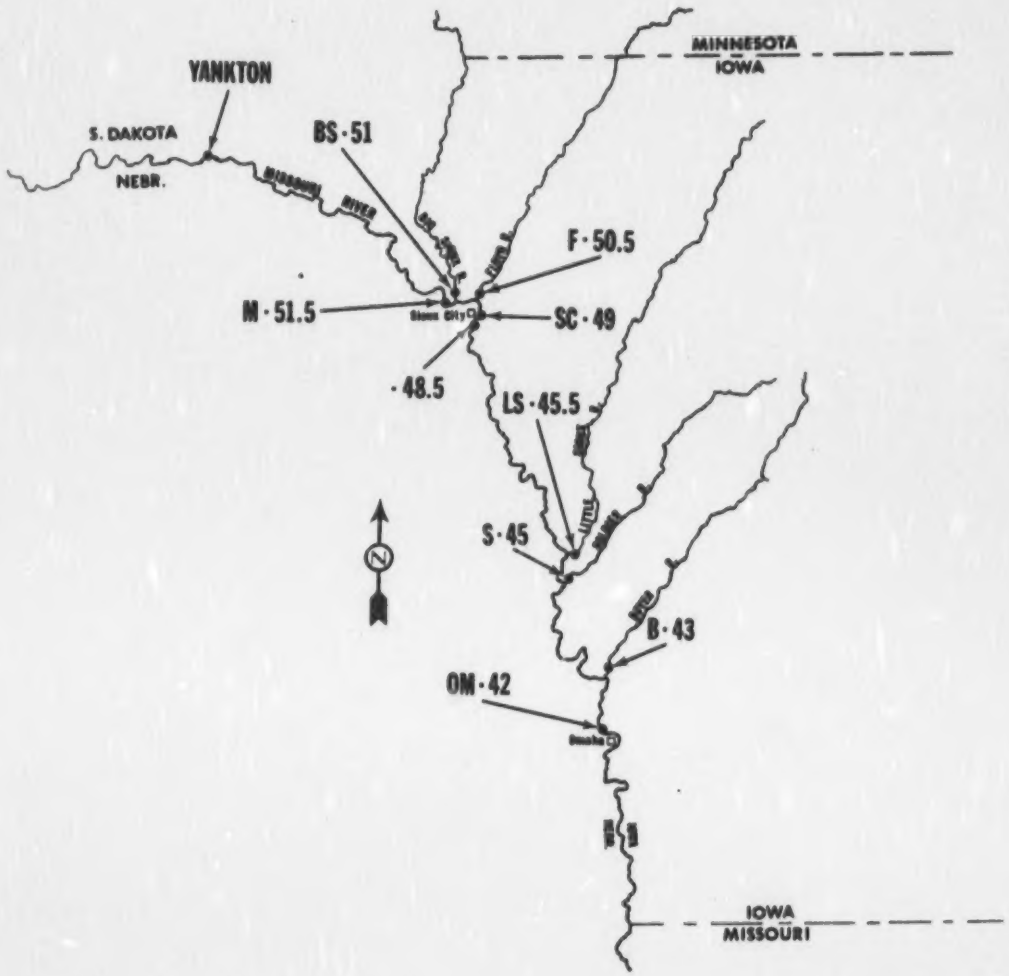


FIGURE 1
MAP OF SURVEY AREA

These observations and tests are a basic part of the sample collection effort. They serve to place the sample in a frame of reference to all other samples and to record those easily observed or determined parameters valuable in interpretation of data from the more complex analyses.

Visual appearance is related to the physical condition of the stream itself and is observed by the sampler at the time of sample collection. With proper training and care the sampler can observe extreme turbidity levels, rising or falling stages, surface appearances, color and other valuable information.

The pH is related to the overall balance of acid and alkaline components in the water. In naturally occurring unpolluted waters the pH is generally predictable within close limits and unexplained departures from the norm serve as a key to further investigation.

Conductance is proportional to the quantity of dissolved minerals in waters in question. Sudden changes in the relative composition of the stream flow such as result from heavy rainfall, discharge of pollutants, tributary inflow, etc., are generally observed to cause changes in the conductivity.

The turbidity is a result of suspended and colloidal matter in the stream which clouds the water and diminishes the penetration of light. Turbidity can be caused by micro-organisms, organic detritus or mineral particles from erosion. Increasing turbidity levels are one of the key analytical signs that spring thaw is occurring with consequent increasing streamflows with higher velocities and resulting erosion of stream bottom and bank sediment deposits.

Group B - Taste and Odor Related Parameters

a. Threshold Odor

b. Phenol

c. Plankton

d. Actinomycetes

e. Carbon Filter Extracts

This group of parameters is keyed to item "a." the threshold odor. When the threshold odor number rises to unsatisfactory levels it was hoped that equivalent rises in either the micro-organisms or the phenolic type compounds could provide direction in determining the source of the odor problem.

The threshold odor test consists of a subjective analysis of the odor from a series of dilution of the stream samples by a panel of analysts. On the basis of the analysts description of the type odor and the intensity as determined from the dilution, it is possible to gain considerable insight into the potential problem to water supplies and its possible source.

Phenolic type compounds, as measured by currently used analytical methods, can come from either industrial or natural sources. Previous investigators have shown that the natural decomposition of organic debris, particularly under anaerobic conditions, results in the production of phenolic type compounds. [13] Phenols can cause taste and odor problems in water supplies at concentration of 0.001 mg/l or less, especially when such waters are subject to chlorination which enhances the odor producing ability. [13]

Plankton is a term which designates the microscopic and near microscopic organisms found suspended in the water. Certain species of algae and other microscopic forms, when found in sufficient numbers, are known to impact undesirable tastes and odors to waters.

Actinomycetes are a group of fungi found in abundance in both aquatic and terrestrial environments. These organisms have been found to readily produce earthy and musty types of tastes and odor when present in sufficient numbers. Investigators have found that chlorination of the by-products of these organisms enhanced the odor intensity.

Activated carbon is an adsorption medium for many types of organic materials, including many of those related to taste and odor problems in water supplies. Residues collected from solvent extraction of carbon columns, after a sufficient quantity of water has been passed through, can be subjected to a variety of other physical, chemical and physiological tests. One of the more complex and more valuable of these subsequent tests involves spectrographic analyses to determine the specific chemical compounds in the residue and similarity of the residue components with known taste and odor producing chemicals.

Group C - Nutrient and Organic Load Parameters

a. Total Phosphorus (Total P)

b. Filtered Ortho-Phosphorus (FOrtho-P)

c. Total Kjeldahl Nitrogen (TKN)

d. Filtered Total Kjeldahl Nitrogen (FTKN)

e. Total Organic Carbon (TOC)

f. Dissolved Organic Carbon (DOC)

g. Dissolved Oxygen (DO)

h. Biochemical Oxygen Demand (BOD_{5-20^oC})

i. Chemical Oxygen Demand (COD_L)

j. CNP - Sediment Analyses

This large group of analyses were included to assist in the development of an overall picture of the existing state and potential of the various streams to carry and remove organic materials and to supply the nutrients and organic materials necessary for the growth of microscopic aquatic life. Dissolved nitrogen, phosphorus and carbon are commonly referred to as macro-nutrients. These are three of the basic life requirements of micro-organisms which the activities of man are most likely to add to the streams in excessive amounts and hence to cause an imbalance in the aquatic environment. These parameters were measured and compared with levels from other known situations to evaluate the potential of the given stream to cause excessive algal growths and hence taste and odor problems. The object of the filtered and unfiltered analyses is to determine that portion which is attached to silt or in the solid form as opposed to the dissolved portion. This information is frequently of value when the data is being interpreted as to the possible source of the nutrients.

The analyses related to oxygen and organic content (DO, BOD, COD, TOC, DOC) are related to the load of organic material in the stream and the combined effect of this load and existing hydraulic conditions. The dissolved oxygen level is affected by biologic activity on the organic materials in the stream. The BOD, COD and TOC, are all measures of the organic load in the stream. There is a definite relationship between these tests. However, this relationship with hydraulic

conditions (i.e. river vs. lake), variations in source of organic material (natural decomposition vs. sewage vs. industrial waste), variations in climatic conditions (hot summer vs. cold winter) and other complicating factors.

Group D - Special Efforts

a. Monitor Operation

b. Total and Fecal Coliform

The MBR-FWQA operates a 4 parameter (Temp., pH, DO, and conductivity) continuous mobile monitor which is capable of producing a permanent continuous record of any or all of the 4 parameters with a minimum of manpower. In situations where the level or concentration of these parameters is expected to change rapidly at a given location, the monitor is an invaluable tool in obtaining a permanent detailed record of these changes at several minute intervals. This effort was cancelled due to failure of the high runoff levels to materialize.

Coliform analyses were performed at all stations as part of our continuing baseline data effort and as part of our continuing concern with locating, documenting and eliminating sources of inadequately treated human and animal wastes which may be considered an unnecessary hazard to the public health or other beneficial water uses.

Detailed Findings of the Survey Efforts

Samples were collected beginning February 2, 1970 and terminating March 31, 1970 at those stations. During the first three weeks of the survey, samples were collected under extreme winter conditions with the smaller tributary streams being completely frozen over with ice

thicknesses of 8" to 12". Snow cover during the period was not extensive and hence, when the thaw began the week of February 22, the anticipated high proportion of tributary inflow to the main stem failed to materialize.

Figure 2 on the following page presents the average daily flow hydrograph for the Boyer River at Logan, Iowa (USGS 6-6095). This is one of the tributaries sampled during the survey and the hydrograph is typical of all tributary stations. The stream at the gaging station drains 871 square miles and has a mean annual flow of 296 cfs. At the time of the spring rise, the surface ice immediately broke up and began moving downstream. Gouging of the banks by ice, coupled with surface runoff and bed and bank erosion caused by increased flow velocities, caused a tremendous increase in the suspended sediment load in the stream. The high turbidity levels which were recorded by the twice weekly sampling show a factor of 300 plus increase on the Boyer River. A tabulation of weekly average turbidity levels for the week of the breakup and a prior week are given below.

TABLE 2

TURBIDITY (HACH 2100)
(JACKSON UNITS)

	Average Before Breakup	Average During Breakup Period	Recorded Maximum
Boyer River	25	990	2600
Soldier River	25	---	5400
Big Sioux River	25	286	550
Little Sioux River	8	246	350

TABLE 2 contd.

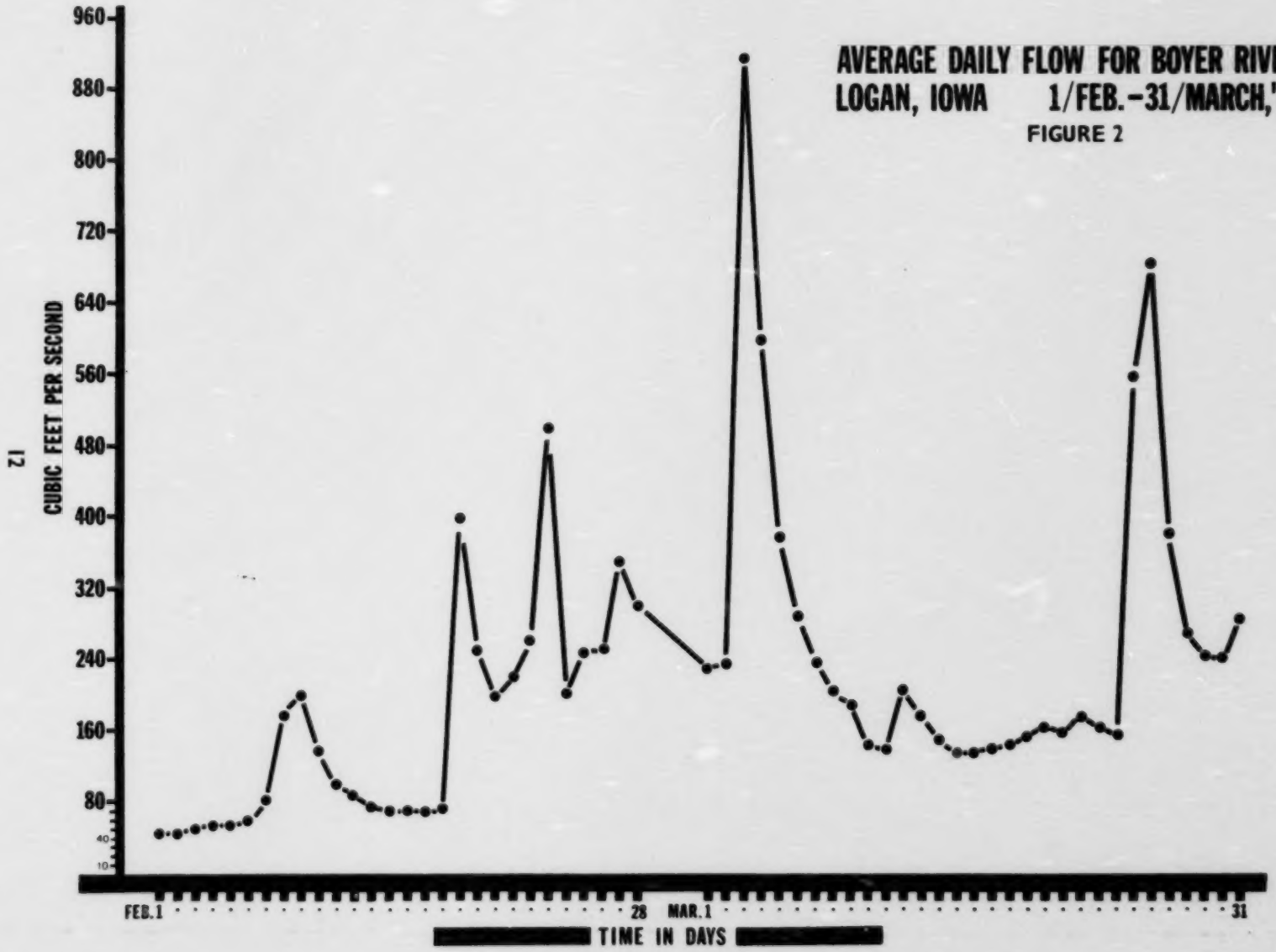
TURBIDITY (HACH 2100)
(JACKSON UNITS)

	Average Before Breakup	Average During Breakup Period	Recorded Maximum
Floyd River	13	355	1300
Missouri River at Sioux City	21	116	260
Missouri River at Omaha	10	287	900

High turbidity levels discharged by tributary streams in the area of concern, indicates a very noticeable effect on water quality at Omaha; an effect which is not as pronounced at Sioux City.

It was unfortunate for the purposes of this survey that the expected high levels of runoff did not occur. As the survey progressed and it became apparent that the high flows would not occur due to lack of snow cover, some originally planned efforts were cancelled, as will be pointed out later.

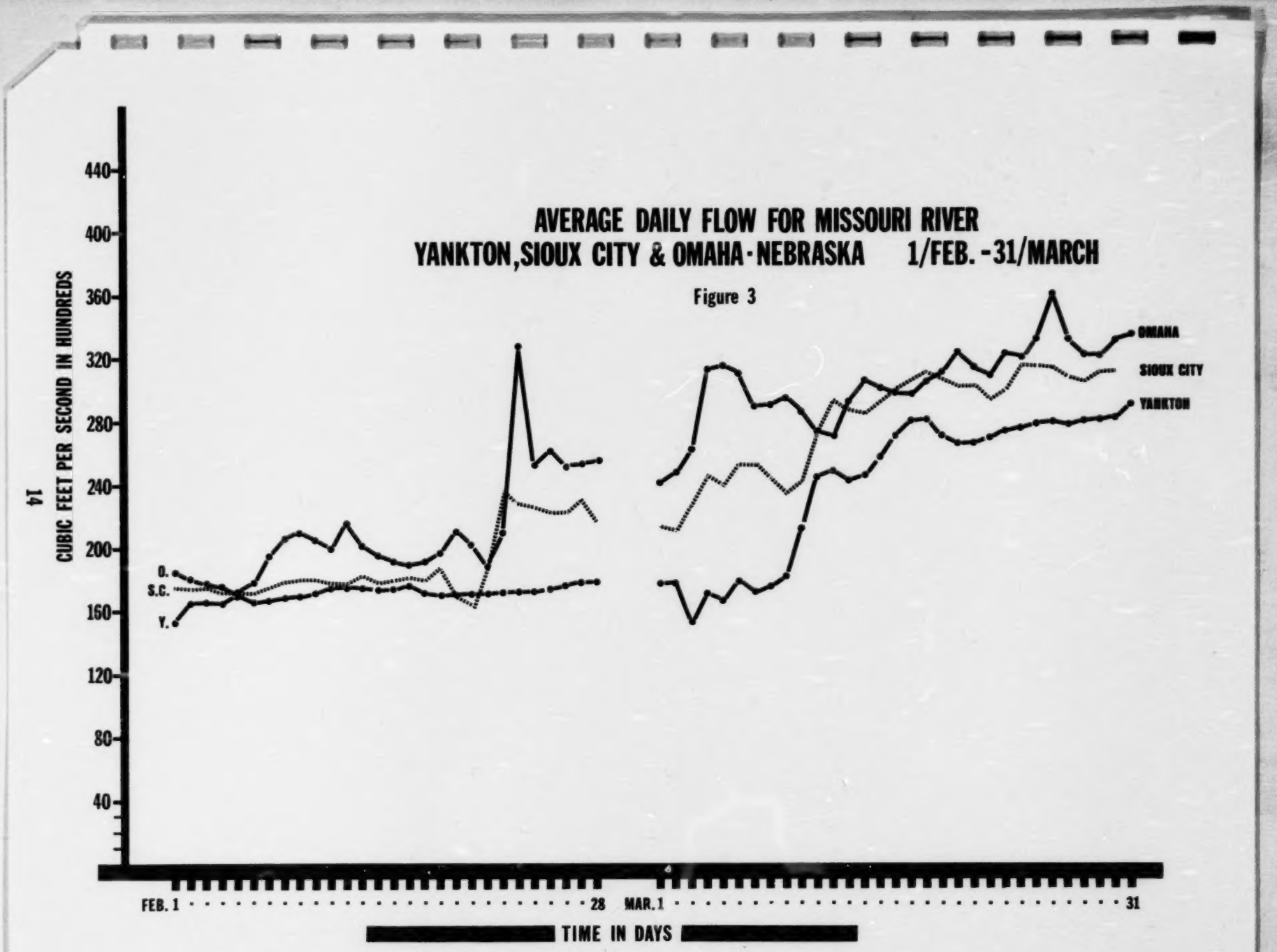
The hydraulics of this portion of the Missouri River system, especially at the time of increased flow releases for navigation and simultaneous spring draining of tributaries is exceedingly complex. Figure 3 has been prepared to illustrate the changing percentage of tributary inflow at the Omaha Waterworks. Daily flow rate for Omaha are given and the flow at Sioux City and at Yankton are given as a percentage of Omaha. On February 23 the flow at Yankton was roughly one-half of the flow at Omaha. Tributary flows at this time made their first rise of the year from low winter levels. On March 5 the sum of flows in the five major tributaries samples in this survey amounts to


AVERAGE DAILY FLOW FOR BOYER RIVER
LOGAN, IOWA 1/FEB.-31/MARCH,'70
FIGURE 2
CUBIC FEET PER SECOND
960
880
800
720
640
560
480
400
320
240
160
80
40
10
FEB. 1
28
MAR. 1
31
TIME IN DAYS

38% of the flow rate in the Missouri River at Omaha for this day. It is likely that this 38% figure adequately represents the maximum tributary inflow percentage at Omaha for the 1970 spring flush. During pre-navigation periods on the Missouri River, tributary inflow reportedly may account for as much as 80 percent of the total flow in the Missouri River at Omaha.

Stream water temperatures prior to the spring breakup were generally less than 0°C due to solids content and the dynamic cooling possible in a moving system. During the flush water temperatures gradually rose to 3 to 4°C by the end of March.

The conductivity levels generally showed an increase on the rising side of the flush hydrograph. The increases recorded for conductivity were not nearly as great as those recorded for turbidity. However, the increases are significant as levels generally doubled or tripled briefly several days before the peak of turbidity. This would indicate that initial meltwater carried in high levels of dissolved decomposition products from the land surface even before increased turbidities occurred to visually show the effects of the thaw. The higher levels of dissolved conservative components are suggestive of similiar increases in components related to the taste and odor problems. Based on the data available, it would appear that the rise in conductivity on the Missouri River at Omaha is not necessarily due entirely to inflows from the major tributaries. A rise of conductivity from about 750 micromhos to 1650 micromhos at Omaha on February 26 was matched by a rise from 750 micromhos to 1490 micromhos at Sioux City the day before. There is, however, a factor of 2 difference in flow volume at the two stations on


AVERAGE DAILY FLOW FOR MISSOURI RIVER
YANKTON, SIOUX CITY & OMAHA - NEBRASKA 1/FEB. - 31/MARCH
Figure 3
CUBIC FEET PER SECOND IN HUNDREDS
440
400
360
320
280
240
200
160
120
80
40
O.
S.C.
Y.
OMAHA
SIOUX CITY
YANKTON
FEB. 1
28
MAR. 1
31
TIME IN DAYS

this day so the effect of the tributaties cannot be dismissed.

Threshold odor samples were tested in cooperation with Dr. R. Anderson and his graduate biology class at U.M.K.C. Lack of experience with this test on the part of all concerned and the subjective nature of the test combined to make the data collected in February questionable, although the values are low as would be expected under bare flow conditions with ice cover. Results obtained for samples collected in March are considered reliable. Although sufficient sample results were not available to draw any detailed conclusions, trends appear significant. Figure 4 on the following page depicts the results of the threshold odor test on samples from the Missouri River above Sioux City and the average threshold odor number for all sample stations located below Sioux City. On March 3, a significant increase occurs in the averaged data line which corresponds to the increase flows as the tributaries were flushed out. The maximum threshold odor number for the entire study occurred on this data at the Boyer River with a level of 31. In the past, odor problems have occurred when threshold odor levels at the intake in Omaha rose to 30 to 35. It is known that taste and odor problems with Missouri River water at Omaha were not severe this past spring.

TABLE 3

PHENOLIC TYPE COMPOUNDS UG/L

	Max.	Date	Min.	Avg.
Missouri River above Sioux City	2.60	3/03/70	0.00	0.76
Soldier River	29.00	2/10/70	0.00	4.87
Boyer River	3.60	3/03/70	0.00	1.96

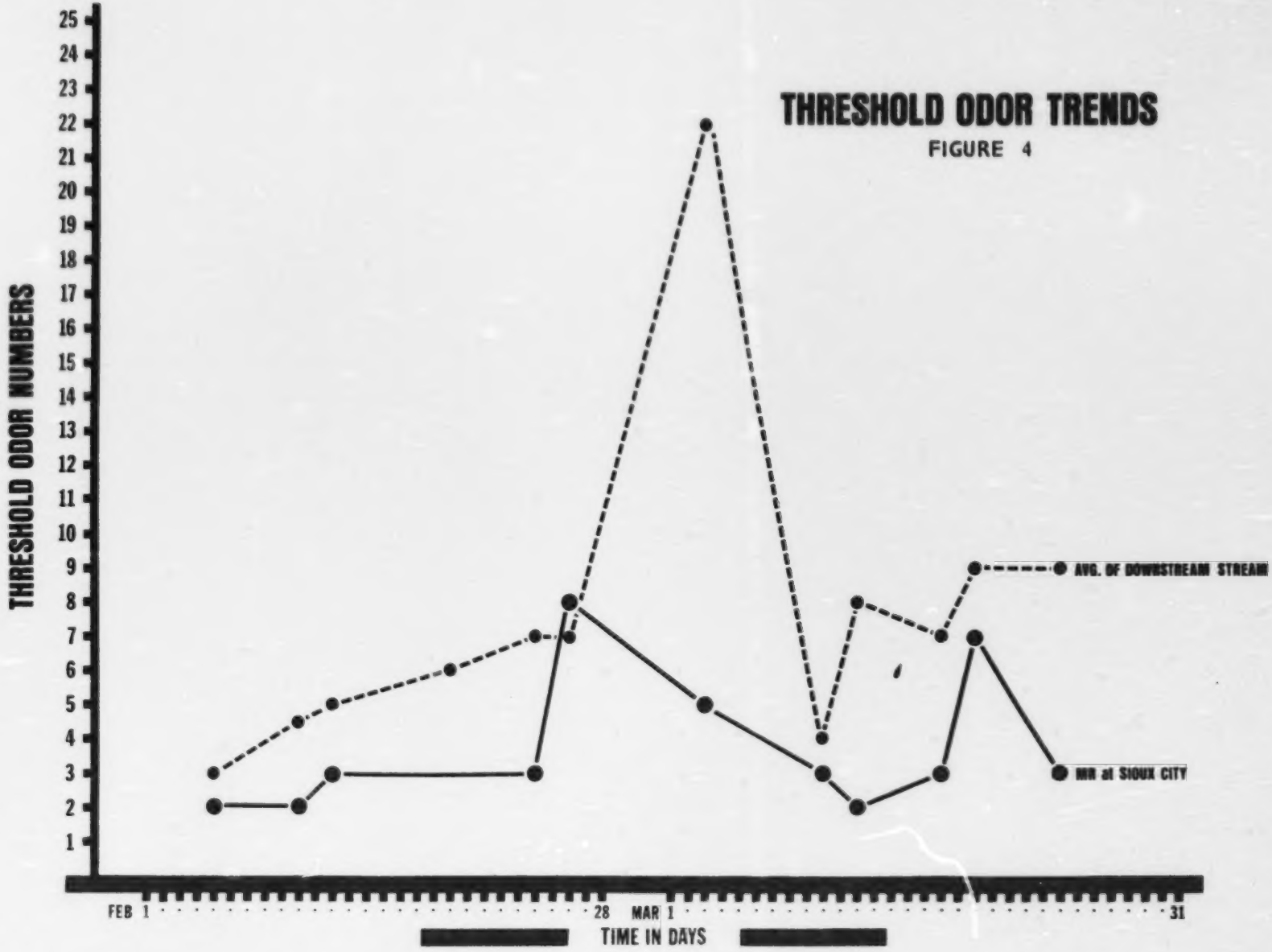
TABLE 3 contd.

PHENOLIC TYPE COMPOUNDS µG/L

	Max.	Date	Min.	Avg.
Missouri River at Omaha	3.10	3/02/70	0.00	0.99
Sioux City STP Effluent	160.00	11/03/70	11.00	82.90

The currently used analytical method for phenols measures not phenols alone but a whole series of organic group compounds that are called "phenolics." It has been reported that strong medicinal odors may occur when phenol concentrations are 2 µG/L yet at other times, when the phenolic concentration was over 50 µG/L, there were no tastes or odors due to phenolic type compounds. 13/ The threshold odor tests run by previous investigators have repeatedly characterized the odor of Missouri River water during problem periods as musty or earthy. Experience with phenol levels on Missouri River waters would indicate that the levels observed during the spring survey with the exception of the STP effluent are due to decaying organic matter (natural vegetation) and are not high enough to be a likely cause of severe odor problems.

Since previous investigators have characterized odors of Missouri River waters as "musty" or "earthy", a biological source has been suspected, particularly actinomycetes. Both the aquatic and terrestrial forms of actinomycetes are known to readily produce the earthy and musty type of odor. In their normal habitats, the actinomycetes may occur as conidium or as vegetative hypae and both forms may give rise to colonies on agar media. It should, therefore, be remembered that numbers themselves mean little, but that trends are often significant. Past work with actinomycetes in surface streams has been limited and no reports


THRESHOLD ODOR TRENDS
FIGURE 4
THRESHOLD ODOR NUMBERS
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
AVG. OF DOWNSTREAM STREAM
MR at SIOUX CITY
FEB 1
28
MAR 1
31
TIME IN DAYS

were available for streams comparable to the Missouri River. For the tributary streams the literature reports normal levels of less than 10 counts per milliliter and counts of 400 colonies per milliliter were the maximum observed during a severe taste problem period. Since actual counts mean little, it is necessary to obtain a correlation for a given place and time when a problem occurs. This was not possible during the Spring of 1970 because severe taste and odor problems did not develop. It is obvious from the levels of actinomycetes which occurred during the spring flush;

a. 11,000 colonies/1 ml on the Big Sioux River on March 3, 1970

b. 12,000 colonies/1 ml on the Soldier River on March 3, 1970

that significant numbers of actinomycetes were flushed into the Missouri River.

In the literature, taste problems due to actinomycetes are reported as related to metabolites produced during the mycelium stage. Since this stage required an aerobic growth period of a week or more, it is quite possible that high counts are only significant when combined with a runoff sequence which involves a high flow which drops rapidly and exposes the banks to warm sun for a period of a week or more before the next high flow. Further study of actinomycetes is needed.

Counts on the Missouri River at the Omaha waterworks intake ranged as high as 510 colonies/milliliter from pre-flush levels of less than 1. The rise of counts generally paralleled the rise in inflow from tributary sources.

Algae are considered by waterworks officials to be the most frequent cause of taste and odor problems in water supplies with decaying

vegetation second in importance. Taste and odor problem attributable to algae are known to occur when certain species are present in numbers as low as 500 cells per milliliter. Certain diatoms, blue-green algae, and pigmented flagellates are principal offenders. A list of Genera found during the Spring of 1970, is found in Table 4 and the Genera with an asterisk are documented as being taste and odor producers when present in bloom proportions.

At no time during the survey did the taste and odor producing algae attain sufficient numbers to cause problems in water supplies. Table 5 lists the phytoplankton counts which include all identifyable algae. As expected, diatoms were the predominant form found throughout the study period, but tapered off in numbers toward the end of the period indicating a seasonal shift to green and blue-green forms. At all stations a peak concentration in numbers occurred at the time of the spring flush with maximums in the tributaries being as high as 9240 per milliliter. Maximum counts at Omaha were nearly twice those recorded for the flush period at Sioux City.

Use of the carbon filter to collect samples for a study of organics of taste and odor significance has been underway at the Missouri River waterworks for about 15 years. It has been determined that there is a buildup of organics in the River as it proceeds downstream and that water treatment processes are not removing significant quantities of organics of taste and odor significance. Basic research by previous investigators has demonstrated that the neutral and weak acid components are those most closely related to taste and odor problems. [2,8]

TABLE 4

PHYTOPLANKTON GENERA OF THE IOWA TRIBUTARIES AND MISSOURI RIVER DURING FEBRUARY THROUGH MARCH, 1970

BLUE-GREEN ALGAE

ANABAENA SP.*
LYNGBYA SP.
OSCILLATORIA SP.*

GREEN ALGAE

ACTINASTRUM SP.
ANKISTRODESMUS SP.
CHLORELLA SP.
COSMARIUM SP.*
KIRCHNERIELLA SP.
MOUGEOTIA SP.
OOCYSTIS SP.
PHYTOCONIS SP.
SCENEDESMUS SP.*

FLAGELLATES

CHRYSOCOCCUS SP.
CHLAMYDOMONAS SP.*
DINOBRYON SP.*
EUGLENA SP.*
PHACUS SP.
TRACHELOMONAS SP.

DIATOMS

ASTERIONELLA SP.*
COCCONEIS SP.
CYMATOPLEURA SP.
CYMBELLA SP.
DIATOMA SP.*
FRAGILARIA SP.*
GOMPHONEMA SP.
GYROSIGMA SP.
MELOSIRA SP.
NAVICULA SP.
NITZSCHIA SP.
PLUEROSIGMA SP.
STEPHANODISCUS SP.*
SURIRELLA SP.
SYNEDRA SP.*
TABELLARIA SP.*

*CAPABLE OF PRODUCING TASTE AND ODOR PROBLEMS

TABLE 5

MISSOURI RIVER AND IOWA TRIBUTARY
PHYTOPLANKTON POPULATIONS IN NUMBERS PER MILLILITER
FEBRUARY -- MARCH, 1970

Station	2/4-5	2/10	2/12	2/16-17	2/24	3/3	3/9-10	3/11	3/16-17	3/19	3/24	3/31
Missouri River (M-51.5)	*Q	Q	Q	Q	2607	1452	1287	902	1034	1155	726	638
Big Sioux River (B5-51)	Q	Q	Q	Q	5874	2574	3102	1749	1188	1716	1482	1650
Floyd River (F-50.5)	Q	Q	Q	Q	3824	9240	1287	660	1144	638	616	794
Little Sioux (LS-45.5)	Q	Q	Q	Q	4158	1640	1784	1881	1485	1485	1221	1716
Soldier River (S-45)	Q	Q	Q	Q	2874	3080	1023	726	891	506	957	957
Boyer River (B-43)	Q	Q	Q	Q	3036	9230	928	855	924	990	1419	738
Missouri (M-42)	Q	Q	Q	Q	3762	4752	2198	1782	924	825	1056	550

*Q - Qualitatively Sampled, Without Cell Count.

During the spring survey identical carbon filter units were operated at Yankton and Omaha on the Missouri River and at the mouth of the Boyer River to assist in obtaining some insight as to the source and relationship of the organic components found in the Carbon Chloroform Extract (CCE). Due to the turbidity levels encountered especially on the Boyer River, it was extremely difficult to obtain an adequate volume of sample from this location.

Looking at the limited data presented in Table 6 it would appear that the major portion of the neutral and weak acid fractions passing Omaha could easily result from tributary inflow. Concentration levels observed at Yankton for the various fractions indicate a very different composition from that found on the Boyer, a characteristic tributary.

The relative levels of the various extract fractions from the Missouri River at Omaha, would appear to represent some combination of the other stations. Past work at the Omaha waterworks on the Missouri River indicates that sample collection techniques are extremely important in the overall recovery. Although the same grade and brand of carbon was used in the filters during our survey the collection techniques varied considerably due to the temporary nature of the collections at Yankton and on the Boyer River. Comparison of the total recovered concentrations should not be attempted.

Previous studies, also at Omaha, demonstrate the range of CCE observed at times during spring runoff events. The following sequence of extractions were performed at Omaha during the 1961 runoff:

TABLE 6

CARBON CHLOROFORM EXTRACTS

TO				FRACTIONS ug/l				
Location	Date	Filtered Volume (Liters)	CCE ppb	Neutral	Water Soluble	Strong Acid	Weak Acid	Base
Missouri at Yankton	3/Feb/70	2100 Est.	75	41	1	4	7	2
	4/Mar/70	2100 Est.	91	34	6	2	6	1
Boyer Near Mouth	2/Feb/70	850	286	100	39	4	8	2
	4/Mar/70	740 Est.	285	105	60	3	17	5
Missouri at Omaha	17/Feb to 23/Feb/70	1533	134	59	9	29	14	21
	5/Mar to 12/Mar/70	1467	226	90	49	6*	20	5
	2/Apr to 6/Apr/70	1400	89	40	20	2	7	2

*Some Lost

TABLE 7

CCE CONCENTRATIONS AT OMAHA IN 1961

Period	Concentration µg/l Raw	Finished
Jan. 2 - 15	18	19
Jan. 15 - 30	20	20
Jan. 31 - Feb. 13	31	22
Feb. 14 - 26	107	63
Feb. 27 - Mar. 13	297	82
Mar. 14 - 27	189	46
Mar. 28 - Apr. 10	70	18

Further work to identify specific components related to taste and odor problems may eventually result in elimination of the problem. In the meantime the CCE remains a useful tool to monitor conditions within the water treatment plant.

Representative nutrient level for selected stations prior to and during the spring flush are presented on Tables 8 through 11 which follow. Analyses of all samples, with one exception, revealed nitrogen and phosphorus levels adequate to support algae in bloom proportions if other conditions were right.

TABLE 12

	Missouri @ Sioux City Geometric Mean Conc. mg/l	Missouri @ Omaha Geometric Mean Conc. mg/l
Total Phosphorus	0.15	0.39
Filtered Ortho-Phosphorus	0.02	0.04
Total Kjeldahl Nitrogen	0.89	1.39
Total Organic Carbon	10.09	15.23
BOD_5	2.14	3.70
Chemical Oxygen Demand	19.24	39.42

The table above presents the geometric mean of concentrations of selected organic and nutrient parameters. It is significant that in all cases mean concentrations are substantially less at the station above Sioux City than at Omaha. Waste effluents in the Sioux City Area and the tributary streams on the Iowa side are the only major possible sources of this increased load. The Sioux City Sewage Plant effluent and the Boyer River were selected as being representative of the two major influent types.

During pre-runoff conditions it is apparent that phosphorus and BOD contributions from municipal waste effluent are a very significant portion of the river load at Omaha especially in light of the small volume of flow which is represented. On February 5th waste discharges from the Sioux City STP which may represent only 50% of all Sioux City Area discharges contributed 25% of the total phosphorus load at Omaha with a volume addition of barely 1 percent. Even at runoff levels the

TABLE 8

MISSOURI RIVER ABOVE SIOUX CITY

Date	February 5, 1970		March 3, 1970	
Flow	17,200 cfs		22,300 cfs	
Parameter	#/Day	mg/l	#/Day	mg/l
Total Phosphorus	2,776	0.03	87,581	0.73
Filtered Ortho-Phosphorus	< 925	<0.01	7,190	0.06
Total Kjeldahl Nitrogen	55,520	0.06	251,950	2.10
Filtered Total Kjeldahl Nitrogen	46,180	0.50	41,990	0.35
Total Organic Carbon	1,110,400	12.00	2,159,500	18.00
Filtered Organic Carbon	555,200	6.00	1,079,700	9.00
Dissolved Oxygen		13.60		13.00
Biochemical Oxygen Demand - 5	203,580	2.20	623,800	5.20
Chemical Oxygen Demand	740,300	8.00	8,038,300	67.00

TABLE 9

SIOUX CITY STP EFFLUENT

Date	February 5, 1970		March 3, 1970	
Flow	8000 gpm (17.9 cfs)		8500 gpm (19.1 cfs)	
Parameter	#/Day	mg/l	#/Day	mg/l
Total Phosphorus	1,387	14.40	1,664	16.20
Filtered Ortho-Phosphorus	799	8.30	1,161	11.30
Total Kjeldahl Nitrogen		NA		NA
Filtered Total Kjeldahl Nitrogen		NA		NA
Total Organic Carbon	12,035	125.0	12,330	120.0
Filtered Organic Carbon	3,370	35.0	4,520	44.0
Dissolved Oxygen		0.00		0.50
Biochemical Oxygen Demand - 5	53,450	555	46,240	450
Chemical Oxygen Demand	75,690	786	85,900	836

TABLE 10

BOYER RIVER NEAR MOUTH

Date	February 5, 1970		March 3, 1970	
Flow	55 cfs		915 cfs	
Parameter	#/Day	mg/l	#/Day	mg/l
Total Phosphorus	133	0.45	98,450	20.0
Filtered Ortho-Phosphorus	130	0.44	395	0.08
Total Kjeldahl Nitrogen	1,154	3 90	334,700	68.0
Filtered Total Kjeldahl Nitrogen	1,154	3.90	15,750	3.2
Total Organic Carbon	5,622	19.0	1,378,600	280.0
Filtered Organic Carbon	1,775	6.0	103,370	21.0
Dissolved Oxygen		8.60		5.40
Biochemical Oxygen Demand - 5	1,657	5.60	182,110	37.0
Chemical Oxygen Demand	5,326	18.0	2,082,300	423.0

TABLE 11

MISSOURI RIVER @ OMAHA

Date	February 5, 1970		March 3, 1970	
Flow	17300 cfs		26400 cfs	
Parameter	#/Day	mg/l	#/Day	mg/l
Total Phosphorus	5,580	0.06	319,600	2.25
Filtered Ortho-Phosphorus	4,650	0.05	5,680	0.04
Total Kjeldahl Nitrogen	72,590	0.78	837,700	5.90
Filtered Total Kjeldahl Nitrogen	65,150	0.70	110,800	0.78
Total Organic Carbon	744,600	8.00*	9,942,200	70.0
Filtered Organic Carbon	465,370	5.00	1,420,300	10.0
Dissolved Oxygen		12.80		10.00
Biochemical Oxygen Demand - 5	102,381	1.10	1,846,700	13.00
Chemical Oxygen Demand	837,700	9.00	23,719,300	167.0

* No sample this day -- estimated by averaging data from nearest two days sampling.

inflow of total and ortho phosphorus from the Sioux City STP is the most significant single source of this major nutrient.

At all times nutrient and organic levels in the tributary streams are higher than those in the main stem flows are derived mainly from storage in the upstream reservoir system. Streamflow in the tributaries is more closely related to runoff and seepage contributions direct from fertilized field, feedlots and other agricultural and agri-business operations.

In the Boyer River parameters representing both dissolved and suspended contributions made concentration increases of 10 to better than 50 fold from pre-runoff to runoff conditions. These concentration increases coupled with a 20 fold flow volume increase resulted in some astonishing differences in organic and nutrient content. This information is all tabulated on the flow tables under discussion so only highlights will be discussed.

TABLE 13

Station	February 5, 1970		March 3, 1970	
	COD #/Day	BOD as % of COD	COD #/Day	BOD as % of COD
Missouri @ Sioux City	740,300	27.5	8,038,300	7.8
Sioux City STP	75,690	70.6	85,900	54.8
Boyer River	5,326	31.1	2,082,300	8.7
Missouri @ Omaha	837,700	12.2	23,719,300	7.8

At all times the COD load imposed on the stream includes more than 70% materials of an organic nature which are not readily decomposed by bacteria as expressed by the standard BOD test. During runoff periods more than 90% of the stream COD is not readily oxidizable. It is likely the partially decomposed natural vegetation both aquatic and terrestrial makes up the bulk of this material. In contrast, wastes from municipal sewage effluent routinely have a BOD of 50 to 75% of the COD level indicating a more readily oxidizable organic content.

A substantial portion of the readily oxidizable organic load is used in the streams to support biological processes. Even in the short flow time reach between Sioux City and Omaha the added organic load and the stream oxidation rate are sufficient to result in a slight oxygen depression at Omaha. In the tributaries some temporary oxygen depression is also noted but only on the Boyer were severe depressions noted and then only on the day of ice break-up. At that time oxygen depression of 9.2 mg/l developed with the resulting stream level of 5.4 mg/l.

During the survey planning stages some concern was expressed over the possibility of significant over-the-winter deposition of organic materials in the lower backwater reaches of the tributaries. It was felt that if this occurred the initial flushing of this material with rising tributary stages would impose a tremendous "slug" load of organic material and nutrients on the main river. In order to attempt to define this effect several sediment sample collection efforts both before and after the spring runoff were made by the MBR biological team. Sediments

were analysed for percent phosphorus, percent organic nitrogen and percent organic carbon. Analyses were performed on sediments from the upper two inches which had been uniformly dried at 50°C. Only three series of samples were collected from each tributary station and the results were not completely uniform. At all 5 tributary stations the phosphorus percentage in sediments was reduced after the spring flush. On the Boyer this reduction amounted to 50% of pre-flush levels. At four of the five tributary stations organic carbon and organic nitrogen were reduced with reductions of over 50 percent occurring a number of times. It is important to note that levels of nitrogen, phosphorus and carbon were quite high at the Big Sioux river sampling location. The "Organic Sediment Index" = OSI = Percent Organic Carbon x Percent Nitrogen for this station ranges to above 0.5 and these sediments can be characterized as "partially stabilized sludge." Additional work needs to be done with this investigation technique. The most serious handicap is relating the percentages of sediment components to a stream load in pounds per day or some similar quantity.

Coliform levels, significance and sources on the main stem Missouri are a source of contention and represent a problem somewhat unrelated to taste and odors. The table below depicts the coliform levels as observed during the spring survey. It is apparent the contributions from waste sources in Sioux City are the major cause of high levels at Omaha at all flow levels observed during the survey.

TABLE 14

Station	Fecal Coliform Levels MF/100 ml		
	Maximum	Minimum	Geometric Mean
Missouri River Above Sioux City	500	10	75
Big Sioux River Near Mouth	1,100	10	218
Floyd River Near Mouth Dakota City	7,000	440	1,744
Iowa Beef Packers Effluent	6,200,000	22,000	465,800
Sioux City STP	57,000,000	4,000,000	11,000,000
Little Sioux River Near Mouth	9,000	10	292
Soldier River Near Mouth	25,000	20	789
Boyer River Near Mouth	10,000	20	734
Missouri River @ Omaha	53,000	940	2,323

SUMMARY

Numerous studies have been made over the past 20 years with the objective of defining the cause and developing possible remedies for the recurrent taste and odor problems in drinking water from the Missouri River. The Spring 1970 effort was intended to define the contribution of taste and odor producing substances and organisms from the tributaries to the Missouri River between Sioux City and Omaha and the overall water quality changes which occur in the Missouri River in the reach at different flow levels.

Tributary runoff volumes during the spring of 1970 did not cause severe taste and odor problems at Omaha. As this fact became known, some resources were diverted from the survey effort and consequently all initially planned work was not accomplished.

CONCLUSIONS

1. The maximum contribution of tributary inflow to the total flow volume on the Missouri River at Omaha during the survey period was estimated to be 40% during the first week of March. Although no severe taste and odor problem developed, the impact of this tributary water was quite noticeable on the quality of water on the Missouri River at Omaha.

2. The maximum threshold odor number which occurred was 31 on the Boyer River during the spring thaw. Difficulty was experienced in setting up and operating a threshold odor panel but this parameter is of extreme importance in the area of taste and odor work.

3. Colony counts of 11,000 and 12,000 actinomycete colonies per milliliter were obtained during the flush period on tributary streams. It is felt that these high counts could be coupled with a specific hydraulic sequence to cause the severe taste and odor problems which have occurred in previous years.

4. The chloroform extracts from activated carbon column samples show significantly higher neutral and weak acid fractions in the Missouri River at Omaha and in the Boyer River than on the Missouri River at Yankton. These are the fractions most suspected of containing the compounds which cause taste and odor problems.

5. During pre-runoff conditions the phosphorus and Biochemical Oxygen Demand loads from municipal and industrial waste discharges in the Sioux City area are a very significant portion of the total load of these parameters in the Missouri River at Omaha.

6. In the tributaries on the Iowa side of the River both the dissolved and suspended nutrient concentrations increased by a factor of 10 to 50 from pre-runoff to runoff flow levels. On the Boyer River the load during the flush period was adequate to cause a dissolved oxygen depression of 9.2 mg/l.

7. Carbon, nitrogen and phosphorus content of sediments from the tributaries were analyzed on a very limited basis. These results appear to support the conclusion that a severe flush of partially stabilized organic sediments occurs with rising flow levels on the tributary streams.

STUDY TECHNIQUES - SPRING 1971

As a result of the 1970 effort and a brief reconnaissance, the following investigation is scheduled for in 1971.

BOYER - 1 (180007) Boyer River at I-29 bridge in Harrison County, Iowa. This station located just above the mouth of the river should provide a composite picture of the quality of water discharged to the Missouri River.

BOYER - 2 Boyer River at CRB, about 1 mile upstream of Woodbine in Harrison County, Iowa. This station is in a representative reach of the stream not close to effects of any municipality or the possible backwater effects of Missouri River levels.

BOYER - 3 Mile Creek near mouth. This small non-perennial stream drains farm land only. No lagre feedlots were observed in this area and no communities discharge effluents to this stream.

BOYER - 4 Boyer River at US 30 bridge about 3 miles below Denison in Crawford County, Iowa. This station is located below all discharges from the Denison area including both IBP and Farmbest.

BOYER - 5 Boyer River at CRB off SR-39 about 3 miles upstream of Denison, Iowa. This station should provide a baseline to evaluate quality conditions at all downstream stations.

Stations 1-4 and 5 are scheduled for carbon filter and sediment sample collection efforts.

All stations are scheduled for sample collection for the following analyses:

1. pH
2. D.O.
3. Conductivity
4. Turbidity
5. Threshold Odor (40° C)
6. COD
7. BOD_5
8. Phenols - twice during pre runoff and daily during runoff
9. Total phosphorus
10. Dissolved Ortho-phophorus
11. Total Kjildahl Nitrogen
12. Dissolved Kjildahl Nitrogen
13. Total Organic Carbon
14. Dissolved Organic Carbon
15. Fecal Coliform
16. Actinomycetes
17. Mercury (twice at Station #1 pre runoff and daily during runoff.)
18. Plankton (weekly)

The following sampling schedule is proposed; twice weekly during pre-runoff for three weeks or until a thaw occurs. If a thaw has not occurred once a week sampling will continue until the thaw occurs.

During the thaw period samples will be collected daily for a 3 to 5 day period. During the thaw additional carbon filter samples will be collected at stations 1, 4 and 5. The mobile monitor unit will be operated at a bridge about 1 mile below station 1 for a period of 48 to 72 hours bracketing the peak of the hydrograph.

Following the thaw weekly sampling will continue for three to five weeks as conditions permit.

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CORRECTIONS TO DATA SHEETS

Station Code Number	River Mile Listed as	River Mile Should be
180009	0635.10	0664.0
180013	0729.00	0727.8
180015	0635.10	0734.0
300222	-	0732.7L

STATION CODE NUMBER - 180006.

AGENCY CODE

LATITUDE-LONGITUDE 41 20 30.0 095 57 30.0

RIVER MILE INDEX1021500114940 009490 0626.20

STATE NAME - IOWA

MAJOR BASIN - MISSOURI RIVER

MINOR BASIN - LOWER MISSOURI

LOCATION DESCRIPTION - MO R OMAHA WATERWORKS INTAKE

STATION DESCRIPTION

MO R OMAHA, NEB WATERWORKS INTAKE 0.3 MI BELOW ST HWY 36 BR FWPCA M-42

4120300 09557300

10.A TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 1800060.
MO R OMAHA WATERWORKS INTAKE
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	63. STREAM FLOW CUFT/SEC	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	69. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 3 315	0.00	17800.00	8.10	12.40	963.00	8.50	*********	46.00	1.00	1.60
70/ 2/ 5 620	0.00-	17300.00	8.00	12.80	797.00	8.10	2.00	9.00	1.10	1.40
70/ 2/10 335	0.00	20500.00	7.90	12.90	774.00	9.00	7.00	34.00	1.70	2.80
70/ 2/12 830	0.00	21500.00	7.70	13.40	796.00	8.00	1.00	31.00	1.20	2.30
70/ 2/17 430	0.00-	19200.00	7.90	13.00	766.00	13.00	*********	8.40	1.20	2.10
70/ 2/19 455	0.00-	21200.00	7.90	13.00	794.00	65.00	8.00	20.00	1.70	2.80
70/ 2/24 655	0.00	25300.00	8.00	11.20	729.00	220.00	7.00	84.00	3.20	5.40
70/ 2/26 445	0.00	25200.00	7.60	12.00	1650.00	130.00	5.00	47.00	2.60	5.40
70/ 3/ 3 2330	2.00	26400.00	7.70	10.00	720.00	900.00	19.00	167.00	4.80	13.00
70/ 3/ 5 45	0.50	28800.00	7.90	10.80	621.00	120.00	3.00	44.00	3.00	7.10
70/ 3/11 2250	0.50	27199.99	7.30	12.20	669.00	90.00	5.00	38.00	2.30	4.80
70/ 3/17 55	1.00	29800.00	7.90	12.80	718.00	45.00	3.00	14.00	0.80	1.80
70/ 3/19 905	1.50	31200.00	7.60	12.80	755.00	45.00	11.00	13.00	1.10	1.90
70/ 3/24 940	2.50	32200.00	8.10	12.50	779.00	85.00	5.00	18.00	0.70	1.30
70/ 3/31 950	4.00	33600.00	8.10	12.70	796.00	65.00	*********	16.00	1.00	1.90
ARITHMETIC MEAN	0.80	25146.64	7.83	12.30	808.86	120.77	6.33	39.42	1.82	3.70
STD. DEVIATION	1.2071	5345.6142	0.2260	0.9397	239.7615	223.4760	4.8679	40.5450	1.1492	3.1251
NO. OF VALUES	15	15	15	15	15	15	12	15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

16

IOWA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180006.
MO R OMAHA WATERWORKS INTAKE
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	32730. PHENOLS UG/L	665. PHOS-T P-WET MG/L	70507. PHOS-T ORTHO MG/L-P	625. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	T ORG C C MG/L	D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 3	315	3.10	0.13	0.13	0.58	0.58	9.00	8.00	**********	**********	**********
70/ 2/ 5	620	0.00	0.06	0.05	0.78	0.76	**********	5.00	**********	**********	**********
70/ 2/10	335	0.10	0.07	0.07	0.56	0.50	8.00	8.00	**********	**********	**********
70/ 2/12	830	0.00	0.07	0.05	0.50	2.30	4.00	4.00	**********	**********	**********
70/ 2/17	430	0.50	0.04	0.04	0.70	0.60	8.00	4.00	**********	**********	**********
70/ 2/19	455	**********	0.16	0.03	0.99	0.44	12.00	4.00	**********	**********	**********
70/ 2/24	655	0.00	0.63	0.03	3.00	1.18	20.00	8.00	**********	**********	**********
70/ 2/26	445	2.80	0.45	0.06	2.10	0.79	17.00	10.00	**********	**********	**********
70/ 3/ 3	2330	2.40	2.25	0.04	5.90	0.78	70.00	10.00	**********	**********	**********
70/ 3/10	45	0.30	0.46	0.07	**********	1.25	19.00	8.00	**********	**********	**********
70/ 3/11	2250	3.00	0.49	0.05	1.53	0.86	**********	6.00	**********	**********	**********
70/ 3/17	55	0.70	0.31	0.02	0.81	0.44	8.00	8.00	**********	**********	**********
70/ 3/19	905	**********	0.15	0.04	0.62	0.25	6.00	5.00	**********	**********	**********
70/ 3/24	940	0.00	0.20	0.03	0.61	0.37	8.00	8.00	**********	**********	**********
70/ 3/31	950	0.00	0.42	0.03	0.69	1.00	9.00	8.00	**********	**********	**********
ARITHMETIC MEAN		0.99	0.39	0.04	1.39	0.80	15.23	6.93	0.00	0.00	0.00
STD. DEVIATION		1.2990	0.5472	0.0268	1.4770	0.5046	17.1956	2.0862	0.0000	0.0000	0.0000
NO. OF VALUES		13	15	15	14	15	13	15	0	0	0

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

19

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180006.
MO R OMAHA WATERWORKS INTAKE
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF=C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	0	2600.00	1700.00	20.00
70/ 2/ 9	620	3400.00	1200.00	1.00-
70/ 2/10	335	3600.00	1400.00	1.00-
70/ 2/12	830	2700.00	2900.00	40.00
70/ 2/16	0	3300.00	940.00	90.00
70/ 2/18	0	3800.00	2600.00	1.00-
70/ 2/24	655	7399.99	1900.00	60.00
70/ 2/26	445	22000.00	7600.00	70.00
70/ 3/ 3	2330	20000.00	93000.00	200.00
70/ 3/10	45	2400.00	1000.00	290.00
70/ 3/12	2250	3000.00	2000.00	910.00
70/ 3/17	55	9400.00	1900.00	110.00
70/ 3/18	905	7100.00	2300.00	1.00-
70/ 3/24	940	6300.00	2100.00	1.00-
70/ 3/31	950	4000.00	1600.00	460.00
ARITHMETIC MEAN		6479.99	5555.99	118.33
STD. DEVIATION		6118.95891	13220.6972	166.7466
NO. OF VALUES		15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

18

STATION CODE NUMBER = 180007.

AGENCY CODE

LATITUDE-LONGITUDE 41 27 30.0 095 56 00.0

RIVER MILE INDEX10215001140940 009490 0635.10

STATE NAME = IOWA

MAJOR BASIN = MISSOURI RIVER

MINOR BASIN = LOWER MISSOURI

LOCATION DESCRIPTION = BOYER R CONFLUENCE WITH MO R

STATION DESCRIPTION

BOYER R 1.0 MI ABOVE CONFLUENCE WITH MO R

SAMPLED BY FWPCA M-43 LAT 4127300 09556000 LONG

10aA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180007.
BOYER R CONFLUENCE WITH MO R
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	10. WATER TEMP CENT	60. STREAM FLOW CUFT/SEC	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	85. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 3	235	1.00	50.00	7.90	*********	1130.00	7.50	*********	59.00	1.80	4.60
70/ 2/ 5	945	0.50	55.00	7.50	7.30	938.00	10.00	7.00	14.00	2.80	5.60
70/ 2/10	305	1.00	140.00	7.70	8.60	628.00	36.00	3.00	66.00	10.00	16.00
70/ 2/12	800	0.00-	90.00	7.70	10.90	696.00	24.00	11.00	43.00	6.20	13.00
70/ 2/17	400	0.00-	70.00	7.80	10.80	816.00	15.00	*********	15.00	2.10	3.60
70/ 2/19	415	0.00-	250.00	8.00	10.30	809.00	36.00	8.00	27.00	3.20	5.60
70/ 2/24	620	0.00-	400.00	8.00	10.60	550.00	290.00	7.00	71.00	9.10	13.00
70/ 2/26	410	0.00-	250.00	7.50	12.00	2250.00	110.00	8.00	74.00	4.50	12.00
70/ 3/ 3	2245	0.00	915.00	7.60	5.40	443.00	2600.00	31.00	423.00	12.00	37.00
70/ 3/10	15	0.00-	142.00	8.10	12.70	707.00	85.00	3.00	36.00	2.30	4.60
70/ 3/11	2225	0.50	140.00	7.80	11.90	754.00	100.00	9.00	31.00	1.60	3.40
70/ 3/17	20	2.50	140.00	8.10	11.70	644.00	65.00	8.00	21.00	1.60	3.20
70/ 3/19	840	1.50	156.00	7.90	12.70	810.00	75.00	13.00	21.00	1.90	3.40
70/ 3/24	905	2.50	156.00	8.10	11.90	683.00	95.00	8.00	52.00	2.90	6.40
70/ 3/31	920	3.50	285.00	8.10	12.10	754.00	160.00	*********	48.00	1.80	3.90
ARITHMETIC MEAN		0.86	215.93	7.85	10.60	854.26	244.56	9.66	67.00	3.98	9.02
STD. DEVIATION		1.1412	219.5061	0.2169	2.1340	417.9130	654.7973	7.2780	100.4353	3.1813	8.8403
NO. OF VALUES		15	15	15	14	15	15	12	15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

10=A TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180067. BOYER R CONFLUENCE WITH MO R MISSOURI RIVER LOWER MISSOURI

DATE	TIME	32730. PHENOLS UG/L	665. PHOS-T P=WET MG/L	70507. PHOS-T ORTHO MG/L=P	629. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	680. T ORG C C MG/L	681. D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 3	235	2.90	0.51	0.50	4.70	4.10	13.00	13.00	**********	**********	**********
70/ 2/ 5	545	3.00	0.49	0.44	3.90	3.90	17.00	6.00	**********	**********	**********
70/ 2/ 9	0	**********	**********	**********	**********	**********	**********	**********	0.05	0.03	0.58
70/ 2/10	305	2.60	0.68	0.69	5.40	4.70	22.00	12.00	**********	**********	**********
70/ 2/12	800	2.50	0.53	0.44	3.70	3.70	**********	16.00	**********	**********	**********
70/ 2/17	400	2.10	0.43	0.40	3.60	3.40	12.00	9.00	**********	**********	**********
70/ 2/19	415	**********	0.41	0.21	3.60	2.70	16.00	6.00	**********	**********	**********
70/ 2/24	420	0.00	0.57	0.16	4.20	2.70	19.00	6.00	**********	**********	**********
70/ 2/26	410	3.60	0.70	0.18	4.30	2.50	24.00	11.00	**********	**********	**********
70/ 3/ 3	2245	2.40	20.00	0.08	68.00	3.20	200.00	21.00	**********	**********	**********
70/ 3/10	15	0.00	0.72	0.31	2.80	1.26	18.00	3.20	**********	**********	**********
70/ 3/11	2225	2.30	0.77	0.24	2.40	1.00	46.00	6.00	0.01	0.07	0.49
70/ 3/17	20	1.10	0.56	0.35	**********	1.53	9.00	9.00	**********	**********	**********
70/ 3/19	840	**********	0.95	0.30	2.10	1.26	9.00	5.00	**********	**********	**********
70/ 3/24	905	2.60	0.60	0.27	3.00	2.00	24.00	10.00	**********	**********	**********
70/ 3/31	920	0.40	0.65	0.29	2.60	1.10	46.00	9.00	**********	**********	**********
70/ 4/ 7	0	**********	**********	**********	**********	**********	**********	**********	0.02	0.03	0.36
ARITHMETIC MEAN		1.96	1.87	0.32	8.16	2.60	39.79	9.33	0.03	0.04	0.47
STD. DEVIATION		1.1885	5.0151	0.1470	17.2465	1.2099	70.1011	4.7809	0.0257	0.230	0.1166
NO. OF VALUES		13	15	15	14	15	14	15	3	3	3

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180007.
BOYER R CONFLUENCE WITH MO R
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF-C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	0	**********	20.00	40.00
70/ 2/ 5	545	300.00	160.00	1.00-
70/ 2/10	305	3600.00	3000.00	1.00-
70/ 2/12	800	1200.00	700.00	1.00-
70/ 2/16	0	160.00	100.00	1.00-
70/ 2/18	0	2300.00	980.00	390.00
70/ 2/24	620	6500.00	3000.00	1.00-
70/ 2/26	410	5700.00	1100.00	100.00
70/ 3/ 3	2245	90000.00	10000.00	260.00
70/ 3/10	15	12000.00	1300.00	330.00
70/ 3/11	2225	3699.99	2200.00	240.00
70/ 3/17	20	1200.00	300.00	1.00-
70/ 3/19	840	900.00	300.00	1.00-
70/ 3/24	905	4000.00	3200.00	1.00-
70/ 3/31	920	5500.00	1400.00	1200.00
ARITHMETIC MEAN		9789.99	1810.66	168.53
STD. DEVIATION		23302.1758	2529.9970	314.2056
NO. OF VALUES		14	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

STATION CODE NUMBER - 180009.

AGENCY CODE

LATITUDE-LONGITUDE 41 43 30.0 096 04 00.0

RIVER MILE INDEX1021500114940 009490 0635.10

STATE NAME - IOWA

MAJOR BASIN - MISSOURI RIVER

MINOR BASIN - LOWER MISSOURI

LOCATION DESCRIPTION - SOLDIER R CONFLUENCE WITH MO R

STATION DESCRIPTION

SOLDIER R ABOVE CONFLUENCE WITH MO R

SAMPLED BY FWPCA S-65 LAT 4143300 09604000 LONG

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180009.
SOLDIER R CONFLUENCE WITH MO R
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	60. STREAM FLOW CUFT/SEC	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	65. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 3 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 3 150	0.00-	96.00	7.80	9.40	819.00	12.00	**********	180.00	5.40	12.00
70/ 2/ 5 450	0.00-	90.00	7.90	9.90	797.00	9.00	2.00	34.00	4.00	13.00
70/ 2/10 235	0.00-	70.00	7.60	8.10	492.00	45.00	6.00	146.00	14.00	29.00
70/ 2/12 720	0.00-	60.00	7.60	8.90	626.00	20.00	3.00	93.00	6.30	14.00
70/ 2/17 315	0.00	95.00	7.90	9.10	776.00	9.00	**********	18.00	1.90	3.50
70/ 3/ 3 2205	0.50	791.00	7.50	8.70	427.00	9400.00	10.00	2160.00	20.00	49.00
70/ 3/ 9 2335	0.00-	69.00	8.10	13.20	707.00	100.00	5.00	24.00	0.80	3.10
70/ 3/11 2200	1.00	85.00	7.90	12.90	685.00	270.00	13.00	90.00	3.10	5.10
70/ 3/16 2325	2.50	97.00	8.20	12.30	796.00	70.00	6.00	28.00	1.00	2.80
70/ 3/19 800	1.00	69.00	8.00	13.10	780.00	100.00	7.00	21.00	1.90	2.70
70/ 3/24 835	2.00	85.00	8.10	11.70	646.00	140.00	10.00	66.00	4.10	8.20
70/ 3/31 855	3.00	192.00	8.00	12.20	689.00	170.00	**********	41.00	1.90	2.90
ARITHMETIC MEAN	0.83	133.29	7.81	10.49	677.16	928.74	7.44	231.08	5.28	11.74
STD. DEVIATION	1.0940	208.9145	0.2698	2.3979	125.4609	1936.0917	4.7987	609.1961	5.8898	13.5414
NO. OF VALUES	12	12	12	12	12	12	9	12	12	12

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STAIAMS STATION 180009, SOLDIER R CONFLUENCE WITH MO R MISSOURI RIVER LOWER MISSOURI

DATE	TIME	32730, PHENOLS UG/L	665, PHOS-T P-WET MG/L	70507, PHOS-T ORTHO MG/L-P	625, TOT KJEL N MG/L	99999, DIS KJEL N MG/L	680, T ORG C C MG/L	681, D ORG C C MG/L	99997, SEDIMENT PHOS PERCENT	99998, SEDIMENT ORG N PERCENT	99999, SEDIMENT ORG C PERCENT
/0/ 2/ 2	130	9.20	0.40	0.40	4.40	3.90	21.00	12.00	**********	**********	**********
/0/ 2/ 9	400	0.00	0.30	0.29	4.30	3.10	23.00	10.00	**********	**********	**********
70/ 2/ 9	0	**********	**********	**********	**********	**********	**********	**********	0.36	0.06	0.69
/0/ 2/10	239	29.00	0.67	0.29	4.80	4.80	23.00	21.00	**********	**********	**********
70/ 2/11	0	**********	**********	**********	**********	3.90	**********	**********	**********	**********	**********
/0/ 2/12	720	1.30	0.44	0.31	4.80	**********	18.00	19.00	**********	**********	**********
70/ 2/17	819	0.00	1.28	0.22	1.19	1.18	12.00	8.00	**********	**********	**********
/0/ 2/ 2	2200	9.20	1.90	0.12	29.00	4.30	300.00	13.00	**********	**********	**********
70/ 2/ 9	0	**********	**********	**********	**********	0.91	**********	**********	**********	**********	**********
/0/ 2/ 9	2359	1.40	0.48	0.16	1.87	**********	12.00	6.00	**********	**********	**********
70/ 2/21	2200	3.70	1.29	0.10	2.80	0.36	**********	8.00	0.82	0.01-	0.28
70/ 2/16	2325	2.90	0.59	0.02	1.63	0.83	9.00	6.00	**********	**********	**********
70/ 2/19	800	**********	0.55	0.15	0.96	0.35	12.00	5.00	**********	**********	**********
/0/ 2/24	655	1.20	0.68	0.14	4.00	3.50	30.00	9.00	**********	**********	**********
/0/ 2/31	455	1.40	0.66	0.15	2.00	0.80	**********	10.00	**********	**********	**********
70/ 4/ 7	0	**********	**********	**********	**********	**********	**********	**********	0.35	0.01-	0.91
ARITHMETIC MEAN		4.87	1.14	0.18	4.73	2.30	54.30	10.38	0.04	0.02	0.59
STD. DEVIATION		8.4447	2.0160	0.1022	6.5420	1.6923	114.7343	4.7185	0.0236	0.0238	0.3431
NO. OF VALUES		11	12	12	12	12	10	12	3	3	3

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

10-A TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180009.
SOLDIER R CONFLUENCE WITH MO R
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF-C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	0	9500.00	3200.00	230.00
70/ 2/ 5	450	9800.00	1800.00	1.00-
70/ 2/10	235	2100.00	1800.00	2100.00
70/ 2/12	720	9100.00	1200.00	410.00
70/ 2/16	0	220.00	20.00	2000.00
70/ 3/ 3	2205	110000.00	25000.00	12000.00
70/ 3/10	0	2900.00	200.00	200.00
70/ 3/12	0	3200.00	1300.00	260.00
70/ 3/17	0	800.00	100.00	510.00
70/ 3/19	800	5800.00	1400.00	1.00-
70/ 3/24	835	7200.00	2600.00	250.00
70/ 3/31	855	1900.00	100.00	20.00
ARITHMETIC MEAN		12543.31	3226.66	1498.49
STD. DEVIATION		30769.9180	6932.7412	3386.0019
NO. OF VALUES		12	12	12

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

STATION CODE NUMBER = 160019.

AGENCY CODE

LATITUDE-LONGITUDE 42 26 30.0 096 23 30.0

RIVER MILE INDEX1021500114940 CD9490 0729.00

STATE NAME = IOWA

MAJOR BASIN = MISSOURI RIVER

MINOR BASIN = LOWER MISSOURI

LOCATION DESCRIPTION = MO R SIOUX CITY STP

STATION DESCRIPTION

MO R SIOUX CITY STP EFFLUENT FWPCA SC-49 4226300 09623300

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STP'S

STATION 10U013.
MO R SIOUX CITY STP
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	50050. CONDUIT FLOW MGD	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	85. ODOR THRESH NUMBER	340. COD HI LEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
69/ 9/ 7 0	**********	1.36	**********	**********	**********	**********	**********	**********	**********	**********
69/ 9/ 8 0	**********	1.69	**********	**********	**********	**********	**********	**********	**********	**********
69/ 9/ 9 0	**********	1.53	**********	**********	**********	**********	**********	**********	**********	**********
69/ 9/10 0	**********	1.63	**********	**********	**********	**********	**********	**********	**********	**********
69/ 9/11 0	**********	1.59	**********	**********	**********	**********	**********	**********	**********	**********
69/ 9/12 0	**********	1.64	**********	**********	**********	**********	**********	**********	**********	**********
70/ 2/ 2 2215	15.50	1.01	7.30	0.30	2630.00	100.00	**********	2060.00	312.00	468.00
70/ 2/ 4 2145	19.00	1.15	7.40	0.00	2235.00	75.00	**********	786.00	297.00	595.00
70/ 2/ 9 2145	18.50	1.15	7.40	0.40	2180.00	130.00	**********	1070.00	226.00	388.00
70/ 2/12 600	16.50	0.86	7.00	0.70	2320.00	60.00	**********	349.00	153.00	262.00
70/ 2/16 2159	17.50	1.15	7.30	0.00	2355.00	95.00	**********	728.00	210.00	298.00
70/ 2/18 2119	17.50	1.30	7.73	0.30	2099.00	120.00	**********	967.00	252.00	383.00
70/ 2/24 10	16.90	0.94	7.40	1.00	1885.00	75.00	**********	435.00	148.00	234.00
70/ 2/25 2259	18.50	1.22	7.20	0.50	490.00	100.00	**********	909.00	302.00	520.00
70/ 3/ 3 2009	19.00	1.22	7.10	0.50	2425.00	200.00	**********	836.00	264.00	450.00
70/ 3/ 9 2190	18.50	1.15	7.10	0.30	2260.00	95.00	**********	670.00	249.00	469.00
70/ 3/11 2050	19.50	1.22	6.90	0.70	2510.00	180.00	**********	942.00	324.00	520.00
70/ 3/16 2140	18.00	1.22	7.20	0.00	2190.00	100.00	**********	681.00	235.00	413.00
70/ 3/19 410	17.50	0.72	7.23	0.40	2175.00	95.00	**********	569.00	182.00	300.00
70/ 3/21 550	**********	0.79	**********	**********	**********	**********	**********	**********	**********	**********
70/ 3/24 430	17.00	0.79	7.20	0.30	2320.00	60.00	**********	670.00	171.00	261.00
70/ 3/31 550	**********	**********	7.10	0.70	2020.00	90.00	**********	539.00	210.00	336.00
ARITHMETIC MEAN	17.75	1.20	7.23	0.36	2096.66	109.00	0.00	772.46	235.93	389.13
STD. DEVIATION	1.1388	0.2936	0.1954	0.3221	488.1110	39.5961	0.0000	409.8681	57.0675	106.7729
NO. OF VALUES	16	21	19	19	19	19	0	19	19	19

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STP'S

STATION 160013.
MO R SIOUX CITY STP
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	32730. PHENOLS	665. PHOS-T P-WET	70507. PHOS-T ORTHO	625. TOT KJEL N	99999. DIS KJEL N	680. T ORG C C	681. D ORG C C	99997. SEDIMENT PHOS	99996. SEDIMENT ORG N	99995. SEDIMENT ORG C
	UG/L	MG/L	MG/L-P	MG/L	MG/L	MG/L	MG/L	PERCENT	PERCENT	PERCENT
70/ 2/ 2 2215	91.00	20.00	11.30	**********	**********	110.00	84.00	**********	**********	**********
70/ 2/ 4 2145	98.00	14.40	8.30	**********	**********	125.00	35.00	**********	**********	**********
70/ 2/ 9 2145	133.00	19.20	13.50	**********	**********	**********	69.00	**********	**********	**********
70/ 2/12 600	11.00	**********	**********	**********	**********	60.00	44.00	**********	**********	**********
70/ 2/16 2155	65.00	24.60	18.00	**********	**********	**********	62.00	**********	**********	**********
70/ 2/18 2115	**********	**********	**********	**********	**********	**********	46.00	**********	**********	**********
70/ 2/24 10	24.50	18.80	6.91	**********	**********	80.00	40.00	**********	**********	**********
70/ 2/25 2255	130.00	**********	**********	**********	**********	130.00	125.00	**********	**********	**********
70/ 3/ 3 2005	130.00	16.20	11.30	**********	**********	120.00	44.00	**********	**********	**********
70/ 3/ 9 2150	70.00	18.40	8.18	**********	**********	**********	60.00	**********	**********	**********
70/ 3/11 2050	160.00	**********	**********	**********	**********	100.00	75.00	**********	**********	**********
70/ 3/16 2140	52.00	18.16	2.72	**********	**********	80.00	60.00	**********	**********	**********
70/ 3/19 410	**********	**********	**********	**********	**********	84.00	54.00	**********	**********	**********
70/ 3/24 430	67.00	**********	7.00	**********	**********	**********	35.00	**********	**********	**********
70/ 3/31 550	46.00	19.20	3.60	**********	**********	**********	**********	**********	**********	**********
ARITHMETIC MEAN	82.88	18.32	9.08	0.00	0.00	98.77	59.50	0.00	0.00	0.00
STD. DEVIATION	45.4799	3.0185	4.5934	0.0000	0.0000	24.1547	24.0217	0.0000	0.0000	0.0000
NO. OF VALUES	13	9	10	0	0	9	14	0	0	0

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STP'S

STATION 1600139.
MO R SIOUX CITY STP
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF-C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2 2215	-65.00	-9.30	1000.00
70/ 2/ 4 2145	-96.00	-7.40	*********
70/ 2/10 0	-130.00	-32.00	1.00-
70/ 2/12 600	-19.00	-15.00	1.00-
70/ 2/16 2155	-60.00	-10.00	1.00-
70/ 2/18 2115	-44.00	-6.10	1.00-
70/ 2/24 10	-36.00	-9.20	1.00-
70/ 2/26 0	-120.00	-97.00	1.00-
70/ 3/ 3 2005	-33.00	-6.80	1.00-
70/ 3/10 0	-54.00	-12.00	20.00
70/ 3/12 0	-97.00	-20.00	1.00-
70/ 3/17 0	-58.00	-4.00	50.00
70/ 3/19 410	-45.00	-5.20	1.00-
70/ 3/24 430	-67.00	-20.00	1.00-
70/ 3/31 550	-51.00	-8.60	210.00
ARITHMETIC MEAN	-59.66	-14.84	92.14
STD. DEVIATION	**********	**********	267.1996
NO. OF VALUES	15	15	14

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

STATION CODE NUMBER - 180019.

AGENCY CODE

LATITUDE-LONGITUDE 42 29 30.0 096 28 30.0

RIVER MILE INDEX1021500114943 009490 0639.10

STATE NAME - IOWA

MAJOR BASIN - MISSOURI RIVER

MINOR BASIN - LOWER MISSOURI

LOCATION DESCRIPTION - BIG SIOUX R ABOVE CONFLUENCE

STATION DESCRIPTION

BIG SIOUX R ABOVE CONFLUENCE WITH MO R SIOUX CITY, IOWA

SAMPLED BY FWPCA BS-51 LAT 4229300 09628300 LONG

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180015.
BIG SIOUX R ABOVE CONFLUENCE
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	60. STREAM FLOW CUFT/SEC	400. PH S U	900. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	69. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 2 1930	0.00-	130.00	8.00	8.30	1330.00	4.00	*********	15.00	1.00	1.90
70/ 2/ 5 40	0.00-	128.00	7.50	7.80	1250.00	11.00	2.00	19.00	1.40	2.20
70/ 2/ 9 2235	0.00	125.00	7.40	7.70	1230.00	12.00	4.00	53.00	4.20	6.90
70/ 2/12 5	0.00	129.00	7.80	8.70	1250.00	8.00	8.00	46.00	3.10	4.70
70/ 2/16 2359	0.00	125.00	7.70	10.60	1219.00	11.00	*********	22.00	1.50	3.80
70/ 2/18 2310	0.00-	180.00	7.50	*********	1209.00	10.00	4.00	13.00	1.30	2.10
70/ 2/24 100	1.00	650.00	7.60	8.70	670.00	55.00	*********	46.00	7.60	6.00+
70/ 2/25 2355	0.00-	650.00	7.40	8.90	2190.00	99.00	*********	89.00	13.00	23.00
70/ 3/ 3 1855	1.00	3000.00	7.50	8.60	480.00	590.00	*********	232.00	16.00	29.00
70/ 3/ 9 1850	0.00	3360.00	7.20	8.90	383.00	160.00	*********	102.00	10.00	26.00
70/ 3/11 1940	0.00-	2340.00	7.20	9.90	492.00	130.00	13.00	82.00	9.60	12.00
70/ 3/16 2100	1.00	1530.00	7.70	10.60	526.00	60.00	9.00	59.00	3.40	6.60
70/ 3/19 440	1.50	1220.00	7.60	11.00	610.00	45.00	10.00	46.00	3.00	7.30
70/ 3/24 510	2.50	970.00	7.90	11.80	707.00	55.00	5.00	36.00	1.90	3.90
70/ 3/31 720	*********	925.00	7.70	11.20	837.00	40.00	*********	28.00	2.10	4.30
ARITHMETIC MEAN	0.50	1030.53	7.58	9.40	984.99	84.40	6.87	59.06	4.87	9.44
STD. DEVIATION	0.7844	1082.9379	0.2306	1.4213	472.6132	137.9996	3.7201	55.5754	4.3145	9.0354
NO. OF VALUES	14	15	15	14	15	15	8	19	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 1800019.
BIG SIOUX R ABOVE CONFLUENCE
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	32730. PHENOLS UG/L	665. PHOS-T P-WET MG/L	70507. PHOS-T ORTHO MG/L-P	625. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	680. T ORG C C MG/L	681. D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 2 1930	0.40	0.63	0.49	3.50	2.60	8.00	4.00	**********	**********	**********
70/ 2/ 5 40	0.00	0.54	0.49	4.70	4.50	17.00	4.00	**********	**********	**********
70/ 2/ 9 2235	2.20	0.80	0.57	4.70	4.20	19.00	6.00	0.12	0.39	5.30
70/ 2/12 5	0.00	0.68	0.53	4.40	4.00	10.00	10.00	**********	**********	**********
70/ 2/16 2355	0.60	0.63	0.44	3.90	3.60	**********	8.00	**********	**********	**********
70/ 2/18 2310	**********	0.69	0.53	3.60	3.20	**********	8.00	**********	**********	**********
70/ 2/24 100	0.00	0.82	0.67	4.60	3.40	20.00	20.00	**********	**********	**********
70/ 2/25 2359	2.30	0.95	0.42	5.30	3.50	29.00	17.00	**********	**********	**********
70/ 3/ 3 1655	9.60	2.00	0.25	7.70	3.90	51.30	18.00	**********	**********	**********
70/ 3/ 9 1850	1.60	1.00	0.28	2.30	2.30	**********	16.30	**********	**********	**********
70/ 3/11 1940	4.20	0.83	0.28	3.90	2.50	52.30	20.00	0.13	0.37	3.20
70/ 3/16 2100	1.20	0.50	0.25	2.60	1.92	10.00	8.00	**********	**********	**********
70/ 3/19 440	**********	0.45	0.32	2.70	1.95	25.00	19.00	**********	**********	**********
70/ 3/24 910	0.00	0.38	0.26	2.00	1.74	8.00	7.00	**********	**********	**********
70/ 3/31 720	0.10	0.40	0.29	10.00	2.00	**********	**********	0.11	0.23	2.70
70/ 4/ 7 0	**********	**********	**********	**********	**********	**********	**********	**********	**********	**********
ARITHMETIC MEAN	1.41	0.79	0.40	4.42	3.00	22.63	11.78	0.12	0.33	3.73
STD. DEVIATION	1.7864	0.3938	0.1362	2.0867	0.9458	15.5510	4.1865	0.0081	0.0871	1.3795
NO. OF VALUES	13	15	15	15	15	11	14	3	3	3

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180019.
BIG SIOUX R ABOVE CONFLUENCE
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF-C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	1930	500.00	400.00	40.00
70/ 2/ 5	40	1800.00	110.00	1.00-
70/ 2/10	0	170.00	40.00	110.00
70/ 2/17	5	150.00	140.00	120.00
70/ 2/18	2359	70.00	10.00	1.00-
70/ 2/18	2310	120.00	50.00	1.00-
70/ 2/24	100	640.00	380.00	1100.00
70/ 2/26	2355	3900.00	600.00	2000.00
70/ 3/ 3	1855	22000.00	1000.00	11000.00
70/ 3/10	0	23000.00	600.00	450.00
70/ 3/12	0	1900.00	1100.00	1200.00
70/ 3/17	0	1100.00	200.00	180.00
70/ 3/19	440	500.00	200.00	1.00-
70/ 3/24	510	600.00	280.00	90.00
70/ 3/31	720	720.00	440.00	30.00
ARITHMETIC MEAN		3811.33	503.33	1088.26
STD. DEVIATION		7634.2783	348.2744	2809.0996
NO. OF VALUES		15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

J3

STATION CODE NUMBER - 180018.

AGENCY CODE

LATITUDE-LONGITUDE

RIVER MILE INDEX102150011494O 009490 0669.20

STATE NAME - IOWA

MAJOR BASIN - MISSOURI RIVER

MINOR BASIN - LOWER MISSOURI

LOCATION DESCRIPTION - LITTLE SIOUX R NEAR RIVER SIOUX

STATION DESCRIPTION

LITTLE SIOUX R AT HWY I-29 BR NEAR RIVER SIOUX, IOWA FWPCA LS-45.5

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IOWA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 100018.
LITTLE SIOUX R NEAR RIVER SIOUX
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	60. STREAM FLOW CUFT/SEC	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	85. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 3 120	0.00-	210.00	7.80 *********	13.90	1075.00	3.50	*********	62.00	0.90	1.70
70/ 2/ 5 410	0.00	210.00	7.70	13.00	979.00	4.70	2.00	10.00	1.60	2.40
70/ 2/10 215	0.00-	260.00	7.70	12.30	856.00	11.00	3.00	37.00	3.50	5.90
70/ 2/12 700	0.00	235.00	7.50	11.60	904.00	10.00	4.00	19.00	5.20	8.50
70/ 2/17 245	0.00	220.00	7.80	13.90	931.00	5.00	*********	18.00	0.90	1.60
70/ 2/19 250	0.00-	400.00	8.20	12.60	819.00	9.00	6.00	11.00	1.30	1.90
70/ 2/24 440	0.00	1300.00	7.90	9.60	500.00	220.00	*********	84.00	12.00	22.00
70/ 2/26 325	0.00-	1100.00	7.40	9.20	2500.00	190.00	*********	89.00	10.00	21.00
70/ 3/ 3 2140	3.30	1240.00	7.80	12.00	523.00	350.00	*********	114.00	4.80	13.00
70/ 3/ 9 2300	0.00-	2290.00	7.40	11.30	502.00	270.00	*********	177.00	5.80	15.00
70/ 3/11 2145	0.50	2180.00	7.30	11.90	514.00	200.00	7.00	86.00	3.90	9.30
70/ 3/16 2305	1.50	1080.00	7.90	13.00	754.00	65.00	13.00	33.00	1.60	3.50
70/ 3/19 740	1.50	1010.00	7.80	12.10	810.00	65.00	6.00	28.00	1.80	3.60
70/ 3/24 820	2.00	876.00	8.10	12.10	764.00	50.00	14.00	38.00	2.00	4.40
70/ 3/31 835	5.00	1200.00 *********		11.90	*********	*********	*********	*********	1.60	3.90
ARITHMETIC MEAN	0.90	920.73	7.73	11.89	887.92	103.80	6.87	57.57	3.79	7.84
STD. DEVIATION	1.4784	683.0158	0.2621	1.2462	500.9039	117.7901	4.4219	47.8229	3.3948	6.8847
NO. OF VALUES	15	15	14	14	14	14	8	14	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

10.A TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180018. LITTLE SIOUX R NEAR RIVER SIOUX
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	32730. PHENOLS UG/L	665. PHOS-T P-WET MG/L	70507. PHOS-T ORTHO MG/L-P	625. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	680. T ORG C C MG/L	681. D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 3	0	•••••••••	•••••••••	•••••••••	•••••••••	1.68	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••
70/ 2/ 3	120	25.00	0.36	0.35	3.50	•••••••••	9.00	3.00	•••••••••	•••••••••	•••••••••
70/ 2/ 5	410	0.00	0.32	0.32	1.85	1.52	9.00	9.00	•••••••••	•••••••••	•••••••••
70/ 2/ 9	0	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••	0.07	0.19	2.05
70/ 2/10	215	2.10	0.40	0.39	1.64	1.53	14.00	13.00	•••••••••	•••••••••	•••••••••
70/ 2/12	700	1.80	0.52	0.50	2.40	2.30	14.00	10.00	•••••••••	•••••••••	•••••••••
70/ 2/17	245	1.80	0.39	0.31	1.75	1.68	10.00	9.00	•••••••••	•••••••••	•••••••••
70/ 2/19	250	•••••••••	0.27	0.22	1.04	0.58	12.00	8.00	•••••••••	•••••••••	•••••••••
70/ 2/24	440	0.60	0.90	0.32	5.10	2.90	29.00	9.00	•••••••••	•••••••••	•••••••••
70/ 2/26	325	6.00	0.88	0.31	5.20	2.50	33.00	17.00	•••••••••	•••••••••	•••••••••
70/ 3/ 3	2140	3.40	0.69	0.24	3.70	1.57	22.00	11.00	•••••••••	•••••••••	•••••••••
70/ 3/ 9	2300	1.80	3.96	0.19	10.00	1.39	25.00	8.00	•••••••••	•••••••••	•••••••••
70/ 3/11	2145	5.00	0.83	0.13	3.30	1.18	60.00	9.00	0.06	0.04	0.49
70/ 3/16	2305	1.30	0.40	0.16	1.65	1.09	12.00	13.00	•••••••••	•••••••••	•••••••••
70/ 3/19	740	•••••••••	0.35	0.16	1.75	1.14	10.00	8.00	•••••••••	•••••••••	•••••••••
70/ 3/24	820	0.90	0.35	0.20	1.90	1.33	10.00	7.00	•••••••••	•••••••••	•••••••••
70/ 3/31	835	1.10	0.63	0.19	2.30	1.00	29.00	10.00	•••••••••	•••••••••	•••••••••
70/ 4/ 7	0	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••	•••••••••	0.04	0.07	0.91
ARITHMETIC MEAN		3.90	0.73	0.26	3.13	1.55	19.60	8.86	0.06	0.10	1.15
STD. DEVIATION		6.5693	0.9168	0.1049	2.2814	0.6111	14.2702	3.3983	0.0172	0.0793	0.8072
NO. OF VALUES		13	15	15	15	15	15	15	3	3	3

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180018.
LITTLE SIOUX R NEAR RIVER SIOUX
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF=C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	0	40.00	10.00	20.00
70/ 2/ 9	410	80.00	10.00	1.00-
70/ 2/10	215	300.00	250.00	30.00
70/ 2/12	700	650.00	600.00	40.00
70/ 2/16	0	60.00	10.00	1.00-
70/ 2/18	0	160.00	70.00	1.00-
70/ 2/24	440	5700.00	2200.00	3000.00
70/ 2/26	325	7399.99	3200.00	90.00
70/ 3/ 5	2140	50000.00	9000.00	1200.00
70/ 3/10	0	2200.00	500.00	350.00
70/ 3/12	0	4000.00	900.00	240.00
70/ 3/17	0	2300.00	500.00	70.00
70/ 3/19	743	2000.00	200.00	1.00-
70/ 3/24	820	6500.00	800.00	220.00
70/ 3/31	839	1400.00	480.00	1900.00
ARITHMETIC MEAN		9519.32	1243.33	477.99
STD. DEVIATION		12950.4277	2321.7793	881.2666
NO. OF VALUES		19	19	19

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

STATION CODE NUMBER = 100019.

AGENCY CODE

LATITUDE-LONGITUDE . .

RIVER MILE INDEX102190311490 009490 0726.83 .

. . . . . .

STATE NAME = IOWA

MAJOR BASIN = MISSOURI RIVER

MINOR BASIN = LOWER MISSOURI

LOCATION DESCRIPTION = IOWA BEEF PACKERS, DAKOTA CITY,N

STATION DESCRIPTION

NO R AT IOWA BEEF PACKERS, INC., DAKOTA CITY, NEBR, PLANT EFFLUENT AT SECOND MANHOLE DOWNSTREAM OF PACKAGE STP ON COMPANY PROPERTY SOUTH OF SIOUX CITY, IOWA FWPCA IBP= 48.5

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IOWA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STP'S

STATION 160019.
IOWA BEEF PACKERS, DAKOTA CITY,N
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	50050. CONDUIT FLOW MGD	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	95. ODOR THRESH NUMBER	340. COD HI LEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
69/ 9/ 8 6909	**********	0.17**********	**********	**********	**********	**********	**********	**********	**********	**********
70/ 1/ 2 1755	16.00	2.40	7.20	9.40	1380.00	120.00	**********	1160.00	229.00	660.00
70/ 2/ 9 2300	22.50	1.70	7.50	4.50	1370.00	90.00	**********	567.00	221.00	421.00
70/ 2/11 2125	29.00	1.80	6.80	1.20	2570.00	260.00	**********	2880.00	538.00	970.00
70/ 2/16 2305	27.50	1.80	7.70	2.00	1775.00	230.00	**********	1310.00	282.00	597.00
70/ 2/18 2355	26.50	1.90	7.90	2.10	1549.99	130.00	**********	795.00	238.00	412.00
70/ 2/24 200	15.00	2.30	7.50	8.00	2825.00	120.00	**********	452.00	169.00	224.00
70/ 2/26 30	18.00	2.00	7.50	6.70	520.00	140.00	**********	464.00	99.00	211.00
70/ 3/ 3 1750	30.00	1.20	6.60	0.00	3290.00	750.00	**********	5800.00	1600.00*	1600.00*
70/ 3/ 9 1950	24.50	1.10	6.60	0.00	2260.00	280.00	**********	3580.00	590.00	1170.00
70/ 3/11 1900	31.00	2.70	7.10	1.20	2135.00	400.00	**********	2980.00	1240.00	1989.99
70/ 3/16 1945	34.00	1.40	7.20	1.20	1950.00	320.00	**********	2850.00	1700.00	2200.00
70/ 3/19 530	29.50	1.80	7.40	3.50	1450.00	190.00	**********	825.00	218.00	408.00
70/ 3/24 615	28.00	1.60	7.30	2.90	1110.00	110.00	**********	683.00	172.00	260.00
70/ 3/31 655	28.00	2.10	7.70	4.10	1285.00	180.00	**********	469.00	121.00	223.00
ARITHMETIC MEAN	25.67	1.73	7.28	2.91	1817.85	223.57	0.00	1773.92	529.21	810.42
STD. DEVIATION	5.7833	0.6081	0.4017	2.1767	741.5904	177.8332	0.0000	1605.7395	559.4744	678.9276
NO. OF VALUES	14	15	14	14	14	14	0	14	14	14

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STP'S

STATION 180019.
IOWA BEEF PACKERS, DAKOTA CITY,N
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	32730. PHENOLS UG/L	665. PHOS-T P-WET MG/L	70507. PHOS-T ORTHO MG/L-P	625. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	680. T ORG C C MG/L	681. D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 2 1755	14.30	8.30	5.12	**********	**********	175.00	100.00	**********	**********	**********
70/ 2/ 9 2300	6.50	8.60	4.68	**********	**********	150.00	31.00	**********	**********	**********
70/ 2/11 2125	19.80	**********	**********	**********	**********	220.00	72.00	**********	**********	**********
70/ 2/16 2305	113.00	14.40	8.72	**********	**********	110.00	73.00	**********	**********	**********
70/ 2/18 2355	**********	**********	**********	**********	**********	110.00	37.00	**********	**********	**********
70/ 2/24 200	18.90	9.40	2.01	**********	**********	**********	40.00	**********	**********	**********
70/ 2/26 30	11.00	**********	**********	**********	**********	60.00	22.00	**********	**********	**********
70/ 3/ 3 1750	53.00	15.60	6.28	**********	**********	725.00	125.00	**********	**********	**********
70/ 3/ 9 1950	19.00	**********	**********	**********	**********	170.00	170.00	**********	**********	**********
70/ 3/11 1900	48.00	**********	**********	**********	**********	820.00	175.00	**********	**********	**********
70/ 3/16 1949	34.00	21.00	3.93	**********	**********	190.00	100.00	**********	**********	**********
70/ 3/19 530	**********	**********	**********	**********	**********	148.00	31.00	**********	**********	**********
70/ 3/24 615	47.00	13.30	1.04	**********	**********	84.00	44.00	**********	**********	**********
70/ 3/31 655	26.00	8.40	5.50	**********	**********	76.00	40.00	**********	**********	**********
ARITHMETIC MEAN	34.17	11.88	4.81	0.00	0.00	194.84	75.71	0.00	0.00	0.00
STD. DEVIATION	29.1872	5.1342	2.4322	0.0000	0.0000	172.3162	51.3785	0.0000	0.0000	0.0000
NO. OF VALUES	12	8	8	0	0	13	14	0	0	0

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STP'S

STATION 180019.
IOWA BEEF PACKERS, DAKOTA CITY,N
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDEMDO MF/100ML	31616. FEC COLI MF-C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	1755	-1.30	770000.00	2300.00
70/ 2/10	0	730000.00	630000.00	1.00-
70/ 2/12	0	-330.00	700000.00	40.00
70/ 2/16	2305	-7.80	-1.30	1.00-
70/ 2/18	2355	-330.00	930000.00	1.00-
70/ 2/24	200	960000.00	180000.00	900.00
70/ 2/26	30	-2.60	290000.00	1.00-
70/ 3/ 3	1750	-8.00	-3.90	100.00
70/ 3/10	0	**********	980000.00	30.00
70/ 3/12	0	-2.70	22000.00	1.00-
70/ 3/17	0	-3.20	270000.00	290.00
70/ 3/19	930	900000.00	80000.00	1.00-
70/ 3/24	615	800000.00	430000.00	20.00
70/ 3/31	655	-8.30	-8.20	20.00
ARITHMETIC MEAN		-68.96	-1.09	211.89
STD. DEVIATION		**********	**********	533.3078
NO. OF VALUES		14	14	14

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

STATION CODE NUMBER = 180020.

AGENCY CODE

LATITUDE-LONGITUDE . .

RIVER MILE INDEX10215001149400 009490 0731.20 .

. . . . . .

STATE NAME = IOWA

MAJOR BASIN = MISSOURI RIVER

MINOR BASIN = LOWER MISSOURI

LOCATION DESCRIPTION = FLOYD R AT SIOUX CITY

STATION DESCRIPTION

FLOYD R NEW CHANNEL AT DACE AVE BR SIOUX CITY, IOWA FWPCA F-50.5

IOWA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180020.
FLOYD R AT SIOUX CITY
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	60. STREAM FLOW CUFT/SEC	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	85. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 2 2145	0.00-	18.00	7.90	12.40	1140.00	6.50	*********	12.00	1.60	2.30
70/ 2/ 4 2215	0.00	20.00	7.70	10.80	1035.00	11.00	2.00	14.00	3.00	4.10
70/ 2/ 9 2215	0.00	33.00	7.80	12.40	912.00	14.00	4.00	46.00	4.60	7.60
70/ 2/11 240	0.00	32.00	7.90	12.40	958.00	11.00	4.00	1.50	3.40	4.70
70/ 2/16 2215	0.00-	25.00	8.10	12.30	1190.00	90.00	*********	63.00	5.70	10.80
70/ 2/18 2235	0.00-	180.00	7.50	9.00	883.00	100.00	4.00	106.00	29.00	44.00
70/ 2/24 55	0.00-	890.00	7.80	10.60	328.00	300.00	8.00	102.00	22.00	39.00
70/ 2/25 2310	0.00-	550.00	7.30	11.00	3000.00	170.00	8.00	153.00	16.00	34.00
70/ 3/ 3 1925	0.00	1860.00	7.60	8.50	315.00	1300.00	*********	559.00	24.00	47.00
70/ 3/ 9 2120	0.00-	301.00	7.80	12.10	698.00	120.00	*********	156.00	4.70	10.00
70/ 3/11 2035	2.50	209.00	7.50	12.00	831.00	140.00	6.00	56.00	2.30	10.00
70/ 3/16 2120	4.00	125.00	7.90	11.90	927.00	55.00	5.00	22.00	1.50	2.80
70/ 3/19 425	1.50	95.00	7.90	12.20	960.00	38.00	9.00	24.00	2.20	3.60
70/ 3/24 450	2.00	95.00	8.00	12.20	870.00	75.00	10.00	30.00	3.00	4.40
70/ 3/31 610	*********	316.00	7.70	11.10	685.00	250.00	*********	99.00	3.50	9.00
ARITHMETIC MEAN	0.71	313.93	7.76	11.39	982.13	178.69	6.00	96.23	8.43	15.59
STD. DEVIATION	1.2817	486.2355	0.2133	1.2424	611.7290	322.3866	2.6246	137.3932	9.3452	16.3295
NO. OF VALUES	14	15	15	15	15	15	10	15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 180020.
FLOYD R AT SIOUX CITY
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	32730. PHENOLS UG/L	665. PHOS-T P-WET MG/L	70507. PHOS-T ORTHO MG/L-P	625. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	680. T ORG C C MG/L	681. D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 2	2145	1.60	0.59	0.58	1.29	1.20	8.00	8.00	**********	**********	**********
70/ 2/ 4	2215	0.00	0.55	0.55	1.68	1.68	14.00	2.20	**********	**********	**********
70/ 2/ 9	2215	2.90	0.60	0.60	2.10	1.93	14.00	13.00	0.09	0.24	2.70
70/ 2/11	240	0.00	0.48	0.47	1.97	0.33	7.00	7.00	**********	**********	**********
70/ 2/16	2215	2.20	0.80	0.48	2.40	2.00	14.00	8.00	**********	**********	**********
70/ 2/18	2235	**********	1.28	0.96	16.00	4.70	40.00	32.00	**********	**********	**********
70/ 2/24	35	0.00	1.40	0.51	8.30	4.30	20.00	16.00	**********	**********	**********
70/ 2/25	2310	3.80	1.34	0.61	8.00	4.50	46.00	23.00	**********	**********	**********
70/ 3/ 3	1925	7.30	3.40	0.13	11.00	4.30	115.00	23.00	**********	**********	**********
70/ 3/ 9	2120	0.30	0.90	0.20	3.65	1.64	110.00	14.00	**********	**********	**********
70/ 3/11	2035	2.50	0.75	0.24	3.30	1.78	**********	12.00	0.00	0.01	0.49
70/ 3/16	2120	0.00	0.45	0.33	1.93	1.14	24.00	20.00	**********	**********	**********
70/ 3/19	425	**********	0.46	0.29	2.10	2.10	12.00	9.00	**********	**********	**********
70/ 3/24	450	0.00	0.42	0.32	1.68	1.32	10.00	10.00	**********	**********	**********
70/ 3/31	610	2.40	0.87	0.27	4.10	1.30	**********	**********	**********	**********	**********
70/ 4/ 7	0	**********	**********	**********	**********	**********	**********	**********	0.05	0.01	0.46
ARITHMETIC MEAN		1.76	1.48	0.43	4.62	2.28	33.38	14.07	0.05	0.08	1.21
STD. DEVIATION		2.1398	2.1848	0.2130	4.3121	1.4230	37.3507	9.0236	0.0483	0.1327	1.2846
NO. OF VALUES		13	15	15	19	19	13	14	3	3	3

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 100020
FLOYD R AT SIOUX CITY
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDIATE MF/100ML	31616. FEC COLI MF=Geo.$ MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	2149	3400.00	440.00	1.00-
70/ 2/ 9	0	790.00	720.00	1.00-
70/ 2/10	0	10000.00	5700.00	6000.00
70/ 2/12	0	1200.00	640.00	7200.00
70/ 2/16	2219	4700.00	1000.00	10.00
70/ 2/18	2239	14000.00	2700.00	1.00-
70/ 2/24	35	23000.00	7000.00	1000.00
70/ 2/26	0	3300.00	3000.00	4000.00
70/ 3/ 3	1929	1700.00	1000.00	9000.00
70/ 3/10	0	5700.00	1600.00	330.00
70/ 3/12	0	11000.00	3099.99	130.00
70/ 3/17	0	3600.00	600.00	80.00
70/ 3/19	425	6500.00	2900.00	1.00-
70/ 3/24	450	6700.00	3400.00	1.00-
70/ 3/31	610	4100.00	2200.00	20.00
ARITHMETIC MEAN		6643.32	2399.99	1891.66
STD. DEVIATION		5872.5976	1924.3105	3100.0249
NO. OF VALUES		15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

STATION CODE NUMBER = 300222.

AGENCY CODE

LATITUDE-LONGITUDE 42 29 12.0 096 25 00.0

RIVER MILE INDEX102150011494.0

STATE NAME = NEBRASKA

MAJOR BASIN = MISSOURI RIVER

MINOR BASIN = LOWER MISSOURI

LOCATION DESCRIPTION = MO R IN SOUTH SIOUX CITY, NEB.

STATION DESCRIPTION

MO R .25 MILE WEST OF US 20, 73 & 77 BR. IN SOUTH SIOUX CITY, DAKOTA CO NEB., NE1/4, SW1/4 SEC 20, T29N, R9E, FWQA SAMPLE STA # 51.1

LAT 4229120 09625000 LONG

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 300222.
MO R IN SOUTH SIOUX CITY, NEB.
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	10. WATER TEMP CENT	60. STREAM FLOW CUFT/SEC	400. PH S U	300. DO MG/L	95. CNDUCTVY AT 25C MICROMHO	70. TURB JKSN JU	85. ODOR THRESH NUMBER	335. COD LOWLEVEL MG/L	304. BOD 2 DAY MG/L	310. BOD 5 DAY MG/L
70/ 2/ 2 1835	0.00-	17400.00	8.30	13.90	853.00	4.60	**********	11.00	0.90	2.10
70/ 2/ 5 2250	0.00	17200.00	8.20	13.60	786.00	7.80	2.00	8.00	1.70	2.20
70/ 2/ 9 2235	0.00	18000.00	8.10	13.40	754.00	17.00	2.00	34.00	1.00	1.70
70/ 2/11 2330	0.00	17800.00	8.00	13.60	764.00	11.00	3.00	1.50	2.50	3.40
70/ 2/16 2235	0.00-	18200.00	8.20	13.50	745.00	12.00	**********	30.00	1.20	2.00
70/ 2/18 2335	0.00-	18700.00	7.70	13.00	979.00	23.00	6.00	12.00	1.20	1.80
70/ 2/24 130	0.00	22600.00	8.20	13.10	707.00	28.00	3.00	6.40	0.80	1.50
70/ 2/25 2355	0.00	22400.00	7.70	14.00	1490.00	40.00	0.00	28.00	0.80	1.10
70/ 3/ 3 1820	2.50	22300.00	7.70	13.00	720.00	260.00	5.00	67.00	2.60	5.20
70/ 3/ 9 1920	0.50	24500.00	7.90	12.60	698.00	50.00	3.00	17.00	1.70	3.20
70/ 3/11 1925	0.50	24100.00	7.60	13.20	707.00	38.00	2.00	19.00	0.50	0.90
70/ 3/16 1915	1.50	29099.99	7.60	12.80	729.00	26.00	3.00	14.00	1.90	3.00
70/ 3/19 505	1.00	31300.00	7.70	13.20	785.00	33.00	7.00	8.80	0.80	1.50
70/ 3/24 540	1.50	29999.99	8.20	13.20	729.00	80.00	3.00	19.00	0.80	0.90
70/ 3/31 630	1.90	31100.00	7.80	13.10	764.00	55.00	**********	13.00	0.90	1.60
ARITHMETIC MEAN	0.60	22979.97	7.92	13.28	813.73	44.36	3.25	19.24	1.28	2.14
STD. DEVIATION	0.8062	5235.5820	0.2550	0.3879	199.8333	62.3861	1.9128	16.0315	0.6479	1.1469
NO. OF VALUES	15	15	15	15	15	15	12	15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

JF

IOwA TRIBUTARIES - 2/2 TO 5/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 300222.
MO R IN SOUTH SIOUX CITY, NEB.
MISSOURI RIVER
LOWER MISSOURI

DATE TIME	32730. PHENOLS UG/L	665. PHOS-T P=ET MG/L	70507. PHOS-T ORTHO MG/L-P	625. TOT KJEL N MG/L	99999. DIS KJEL N MG/L	680. T ORG C C MG/L	681. D ORG C C MG/L	99997. SEDIMENT PHOS PERCENT	99996. SEDIMENT ORG N PERCENT	99995. SEDIMENT ORG C PERCENT
70/ 2/ 2 1035	1.70	0.13	0.10	0.50	0.55 **********		3.00 **********	**********	**********	**********
70/ 2/ 5 2250	0.00	0.03	0.01-	0.60	0.50	12.00	6.00 **********	**********	**********	**********
70/ 2/ 9 2235	1.70	0.03	0.02	0.20	0.29	14.00	8.00 **********	**********	**********	**********
70/ 2/11 2330	0.00	0.06	0.04	4.20	0.60	6.00	6.00 **********	**********	**********	**********
70/ 2/16 2235	0.00	0.05	0.02	0.60	0.40	8.00	8.00 **********	**********	**********	**********
70/ 2/18 2335 **********		0.05	0.02	0.45	0.33	11.00	8.00 **********	**********	**********	**********
70/ 2/24 130	0.00	0.08	0.02	0.55	0.18 **********		7.00 **********	**********	**********	**********
70/ 2/25 2355	0.00	0.09	0.02	0.80	0.18	8.00	8.00 **********	**********	**********	**********
70/ 3/ 3 1820	2.60	0.73	0.06	2.10	0.39	18.00	9.00 **********	**********	**********	**********
70/ 3/ 9 1920	1.40	0.36	0.03	0.75	0.50	10.00	10.00 **********	**********	**********	**********
70/ 3/11 1925	2.40	0.19	0.02	0.46	0.08	9.00	9.00 **********	**********	**********	**********
70/ 3/16 1915	0.00	0.10	0.02 **********		0.44 **********		10.00 **********	**********	**********	**********
70/ 3/19 505 **********		0.10	0.03	0.60	0.52	8.00	7.00 **********	**********	**********	**********
70/ 3/24 940	0.00	0.10	0.02	0.44	0.36	7.00	7.00 **********	**********	**********	**********
70/ 3/31 630	0.20 **********		0.01	0.29	0.05 **********		5.00 **********	**********	**********	**********
ARITHMETIC MEAN	0.76	0.15	0.02	0.89	0.35	10.09	7.40	0.00	0.00	0.00
STD. DEVIATION	1.0290	0.1871	0.0231	1.0488	0.1728	3.5056	1.8822	0.0000	0.0000	0.0000
NO. OF VALUES	13	14	15	14	15	11	15	0	0	0

ADDITIONAL PARAMETERS AVAILABLE FOR STATION

IOWA TRIBUTARIES - 2/2 TO 9/30/70 - PRELIMINARY RETRIEVAL NOV. 23, 1970 STREAMS STATION 300272.
MO R IN SOUTH SIOUX CITY, NEB.
MISSOURI RIVER
LOWER MISSOURI

DATE	TIME	31501. COLIFORM IMEDENDO MF/100ML	31616. FEC COLI MF-C44.5 MF/100ML	99998. ACTINO-MYCETES COUNT/ML
70/ 2/ 2	1835	1.00-	100.00	1000.00
70/ 2/ 5	2250	130.00	40.00	1.00-
70/ 2/10	0	170.00	40.00	110.00
70/ 2/12	0	600.00	150.00	90.00
70/ 2/16	2235	120.00	30.00	12.00
70/ 2/18	2335	380.00	130.00	23.00
70/ 2/24	130	500.00	80.00	20.00
70/ 2/26	0	160.00	20.00	10.00
70/ 3/ 3	1820	1500.00	500.00	1600.00
70/ 3/10	0	500.00	150.00	110.00
70/ 3/12	0	600.00	40.00	940.00
70/ 3/17	0	50.00	10.00	20.00
70/ 3/19	505	400.00	240.00	100.00
70/ 3/24	540	330.00	200.00	70.00
70/ 3/31	630	150.00	70.00	20.00
ARITHMETIC MEAN		372.73	120.00	248.39
STD. DEVIATION		369.3764	125.6610	460.9946
NO. OF VALUES		15	15	15

ADDITIONAL PARAMETERS AVAILABLE FOR STATION